

RESEARCH REPORT

Are Mixed Economies Persistent or Transitional? Evidence Using Social Networks from Arctic Alaska

Shauna BurnSilver, James Magdanz, Rhian Stotts, Matthew Berman, and Gary Kofinas

ABSTRACT Two opposing narratives describe future prospects for mixed economic livelihoods in Alaska and the broader Arctic. On the one hand, Arctic anthropologists have written about the emergence of persistent mixed economies in Native communities. A second narrative echoes modernization assumptions and assumes that “subsistence is dying,” mixed economies are transitional, and Native communities are headed inevitably toward full market dependence. We provide evidence that mixed economies are not transitional. Mixed economies have three components: households engage in (1) market exchange, (2) subsistence activities, and (3) culturally embedded social relationships sustained by flows of wild food and other resources. Using household-level social network and economic data from two Iñupiat communities spanning 30 years, we explore hypotheses designed to test an assumed transition to market dependence. If transition assumptions hold, households with high engagement in the cash economy will have low engagement in subsistence production and diminished social relationships. Results do not support this narrative of change. Although there is considerable variability in household harvest, income, and social relationships, those highly engaged in market activities are also disproportionately involved in subsistence activities, sharing, and cooperation. Beyond broad narratives, an assessment of underlying processes and conditions supporting persistent mixed economies is warranted. [*Arctic, mixed economies, subsistence hunting, cash economy, social networks*]

RESUMEN Dos narrativas opuestas describen las perspectivas de futuro de los medios económicos mixtos de sustento en Alaska y más ampliamente en la región ártica. Por un lado, los antropólogos de la región ártica han escrito sobre la emergencia de persistentes economías mixtas en comunidades nativas. Una segunda narrativa hace eco de las asunciones de la modernización y asume que esa “subsistencia está muriendo”, las economías mixtas son transicionales, y las comunidades nativas se están dirigiendo inevitablemente hacia una dependencia total de los mercados. Proveemos evidencia que las economías mixtas no son transicionales. Las economías mixtas tienen tres componentes: hogares toman parte en (1) intercambio en los mercados, (2) actividades de subsistencia, y (3) relaciones sociales culturalmente embebidas sostenidas por flujos de alimentos silvestres y otros recursos. Usando redes sociales a nivel de hogares e información económica de las dos comunidades Iñupiat abarcando 30 años, exploramos hipótesis diseñadas para evaluar una asumida transición a una dependencia de mercados. Si las asunciones sobre la transición se sostienen, los hogares con alto involucramiento en la economía monetaria tendrán bajo involucramiento en la producción de subsistencia y reducidas relaciones sociales. Los resultados no apoyan esta narrativa de cambio. Aunque hay una considerable variabilidad en la cosecha del hogar, el ingreso y las relaciones

sociales, aquellos altamente involucrados en actividades de mercado están también desproporcionadamente involucrados en actividades de subsistencia, en compartir y cooperación. Mas allá de amplias narrativas, una evaluación de los procesos subyacentes y las condiciones apoyando las persistentes economías mixtas es requerida. [*Región ártica, economías mixtas, caza de subsistencia, economía monetaria, redes sociales*]

On May 12, 2015, Alaska Governor Bill Walker signed a new Arctic policy into law (Alaska Statutes 44.99.105). Synthesizing two years of stakeholder meetings by the Alaska Arctic Policy Commission, the policy recognizes the indigenous majority in the Alaskan Arctic, whose “physical and spiritual well-being depends on protecting the bountiful lands, rivers, and seas of the Arctic.” The policy’s focus, though, is “to uphold the state’s commitment to economically vibrant communities sustained by development activities,” and it emphasizes extractive natural resource development.

The policy echoes a specific narrative about Arctic development and indigenous peoples. As the Arctic melts, new natural resource opportunities and transportation corridors are fueling economic growth that could benefit indigenous and other Alaskans alike (Alaska Arctic Policy Commission 2015). Indigenous societies—overwhelmed by poverty, eroding cultural values, climate change, declining wildlife, and development impacts—are seen as particularly in need of this development (O’Malley and Orlinsky 2015).

Modernization theory was a cornerstone of 1950s and 1960s anthropology, including Arctic anthropology (Chance and Trudeau 1963; Murphy and Steward 1956; VanStone 1960). It suggested a logic by which market and cultural acculturation would inevitably transition Arctic groups away from subsistence-based livelihoods. Now largely discredited within the discipline, modernization themes are still tacitly expressed in economic and policy discussions and by the media. For example, Thomas Morehouse (1989) argued that subsistence declines required market expansions to maintain community economic viability. Marcelle Chabot (2003) suggested that continued sharing between households would reflect poverty conditions not cultural identity or choice. Craig Medred (2013), a widely read Alaska journalist, put it bluntly: “Subsistence itself is dying beneath a population boom and the changing views of an evolving society.” But for many Arctic scholars, this “dying subsistence” narrative is not persuasive.

In this research report, we explore a counternarrative to market transition and development: persistent mixed economies (Kruse 1991; Langdon and Worl 1981; Lonner 1986; Usher 1981; Wenzel 1991). The recent Arctic Human Development Report describes indigenous communities as maintaining subsistence production within traditional social structures, exploiting new economic opportunities, and creating increasingly complex socioeconomic dynamics (Nyman Larson and Fondahl 2014; see Poppel and Kruse 2010). While people are employed, they remain hunters and

fishers and engage in a moral economy of sharing and cooperation around food and other resources (Bodenhorn 2000). They also invest income in subsistence supplies and better equipment and negotiate work schedules to fit seasonal subsistence patterns (Kruse 1986; Langdon 1991). Robert Wolfe and Robert Walker (1987) advanced the proposition that 30 percent of a community’s households produce 70 percent of a community’s wild foods, a pattern subsequently observed throughout rural Alaska (Wolfe et al. 2009). These “super-households” presumably produced beyond their needs to provision others (Wolfe et al. 2009).

Though often characterized as a critical component of mixed economies, food and resource redistributions have been largely described qualitatively because they are rarely quantified (see Harder and Wenzel 2012). Synthesizing economic, harvest, and social data helps clarify which narrative—gradual market transition versus persistent mixed economies—better reflects Arctic communities today. We collected social network, harvest, and economic data in 2009–10 in two Alaskan Iñupiat communities and compared patterns to existing data across three decades. If mixed economies are persistent, we would expect the following:

1. Substantial harvests of wild food and resource redistribution among households, structured by social relationships;
2. no declines in households’ mean subsistence harvests or social relations over time; and
3. strong engagement of higher-income households in subsistence production.

STUDY SITE AND DESIGN

Wainwright and Kaktovik are isolated Iñupiat whaling communities with Alaska Native majorities (95% and 88%, respectively), unconnected to Alaska’s road system and accessible only by air (Figure 1). Residents harvest wild foods from land, rivers, and ocean. Hunting and fishing activities typically involve cooperation among multiple households. Bowhead and beluga whale production is culturally complex, involving cooperation by virtually all capable community members and ritualized food distributions through shares and feasts.¹

We collected data through ethnographic interviews and a comprehensive household survey. Following Donald Bender (1967) and Peter Usher and colleagues (2003), “households” were defined as individuals coresident within

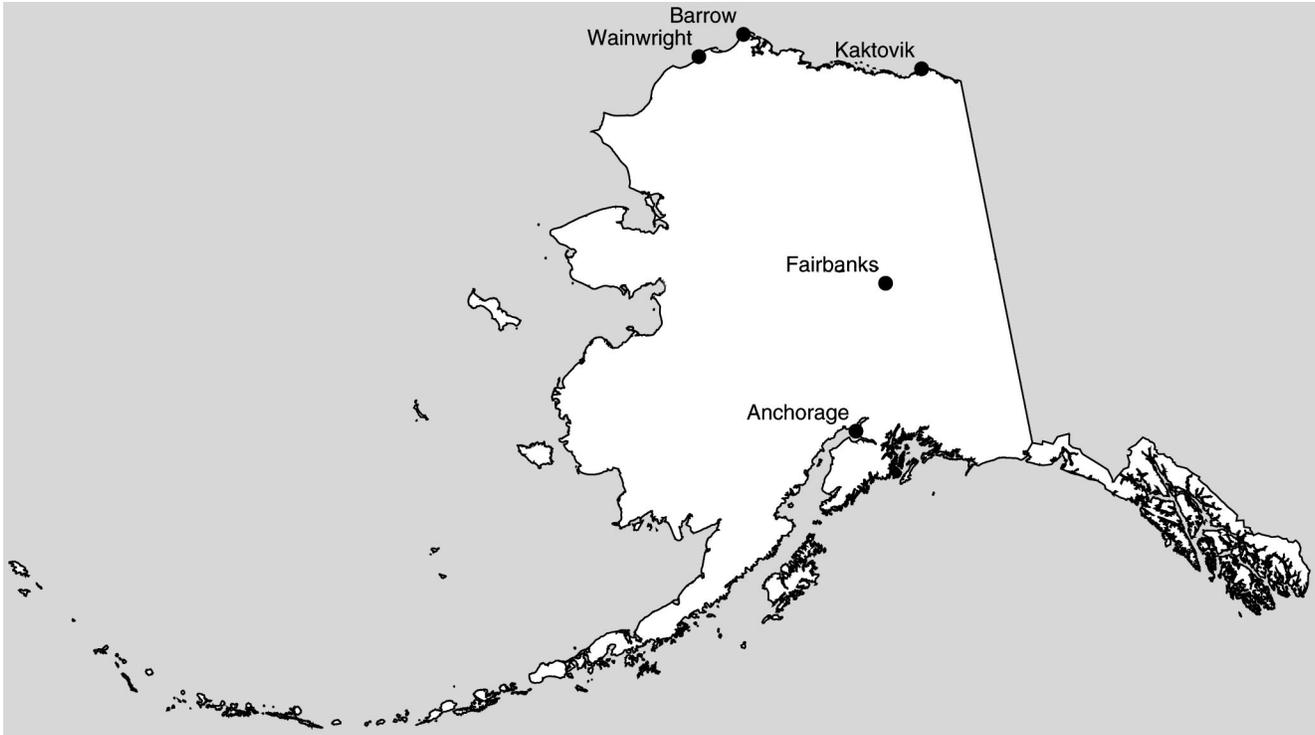


FIGURE 1. Map of Alaska with the two study communities, Kaktovik and Wainwright.

a dwelling who cooperated on domestic functions. Only 4 percent of sampled households included non-kin. We administered surveys to heads of 146 Wainwright and 69 Kaktovik households (96% and 80% of households, respectively).² Respondents estimated annual income from employment, pensions, dividends, and public assistance, including annual dividends from the Alaska Permanent Fund and Native for-profit corporations.³ We used U.S. Census data and two earlier harvest studies (Kruse 1991; Kruse et al. 1982) to compare income and harvest over time.

Using social network methods, we represented flows of wild food and non-food resources between households over a 12-month period. Interviews with local hunters, elders, and community members allowed us to identify locally resonant relationships and key species (Table 1). For example, respondents distinguished *sharing*—receiving food without a specific expectation of return—from *helping shares*—food received based on contributing labor, equipment, or supplies to the subsistence efforts of others. Survey respondents identified households and whaling crews who provided wild food, goods, and services to the respondents' households for each combination of species and social relation. By aggregating these connections across each community, we constructed valued and directed multiplex social networks in which households, whaling crews, and other organizations are nodes connected by valued and unvalued edges (flows and ties, respectively; see Borgatti et al. 2009). To estimate a household's subsistence harvest, we summed meat or fish in pounds stemming from household members' own harvesting, cooperative harvest relations, and community harvests.

Unvalued household ties reflect summed counts across different types of non-food contributions such as labor, equipment, and supplies. Food moving in and out of households represents "inflows" and "outflows," respectively, while we denote incoming and outgoing contribution ties as "indegree" and "outdegree" (Table 2).

RESULTS

Table 1 sums flows in pounds and counts of ties for all relations and eight resources in each community for a 12-month period. Households' "own hunting" provided only 25 percent and 21 percent of total flows in Wainwright and Kaktovik, respectively, highlighting the continued importance of social relations in structuring wild food flows. Table 1 also illustrates the substantial contributions of social relations unique to whaling (e.g., feast, crew, and helper shares). Findings mapped closely onto previous results from Nelson 1969 and Bodenhorn 2000.

DIACHRONIC TRENDS

Between 1977 and 2010, indicators of subsistence engagement—per capita harvests, giving food away, and receiving food from others—showed either no trend or increased engagement (Table 3). Per capita harvest and income both increased at similar rates from 1987–2009. In 2009–2010, engagement with both economic sectors was substantial; calculated average annual per capita subsistence harvests were 872 pounds in Kaktovik and 705 pounds in Wainwright, while average annual per capita incomes were \$31,809 and \$27,820, respectively. At the household level,

TABLE 1. *Aggregated Flows of Wild Food and Contributions for All Social Relationships by Community*

Social relationships	Flows and ties			
	Wainwright (<i>n</i> = 146)		Kaktovik (<i>n</i> = 69)	
<i>Valued flows (non-whale)</i>				
Own hunting	102,587	lbs.	47,813	lbs.
Cooperative hunting shares	112,117		42,441	
Helper shares	13,294		5,435	
Sharing	40,646		19,943	
Trading	1,807		407	
Purchase	1,341		23	
<i>Valued flows (beluga and bowhead whales)</i>				
Cooperative hunting Shares (beluga only)			9,700	
Helper shares (whaling crew contributions)	8,470		5,113	
Sharing	3,825		12,443	
Crew shares	50,146		50,107	
Towing shares	14,156		965	
Captain's shares			14,255	
HH shares	29,331		349	
Captain's feasts	5,325		2,849	
Nalukataq	20,622		6,795	
Trading	416		73	
Sum - all flows	404,084	lbs.	223,615	lbs.
<i>Non-food resource ties</i>				
Processing (between households)	444	ties	496	ties
Shared cash	36		36	
Lent equipment	157		109	
Repaired equipment	62		53	
Hunting contributions:				
Labor	266		114	
Ammunition	32		19	
Cash	19		6	
Gasoline	83		38	
Equipment	125		28	
Supplies	73		37	
Sum—all ties	1,297	ties	948	ties

Note: Food is represented in edible pounds and contributions are counts of different kinds of ties. Common species hunted in both villages were bowhead, beluga, bearded seal, caribou, and geese. Unique hunted species were as follows: for Wainwright, smelt and ducks; for Kaktovik, Dall sheep and Arctic char.

neither harvest nor social engagement declined as employment and income rose.

HOUSEHOLD AND INCOME RELATIONSHIPS: 2009–2010

Consistent with Wolfe and Walker (1987), 30 percent of Wainwright and 23 percent of Kaktovik households accounted for 70 percent of harvested food flows. Pearson correlations between harvest and earned income were

weakly positive ($r = 0.256$, $p < 0.01$ [Wainwright], $r = 0.123$, N.S. [Kaktovik]) and marginally stronger for harvest and gross income inclusive of dividends and assistance ($r = 0.283$, $p < 0.01$ [Wainwright], $r = 0.219$, N.S. [Kaktovik]). Observed harvest–income relationships varied widely, but high-income households did not cluster at low harvest levels (see online supplementary Figure 1 for more detail).

We divided households in each community into income and harvest terciles. A Kendall's Tau-b analysis (3×3

TABLE 2. Network Terminology for Flows of Wild Foods and Contribution Ties

Network ties represent:	Direction of Ties	
	Incoming ties to HH	Outgoing ties from HH
Valued flows (<i>summed flows of species by relation – lbs. of food</i>)	inflow	outflow
Unvalued ties (<i>counts of contributions by relation – no. of ties</i>)	indegree	outdegree

TABLE 3. Characteristics of Wainwright and Kaktovik Mixed Economies through Time

Year	1977	1980	1987	1988	1990	2000	2009
<i>Kaktovik</i>							
HHs employed/harvests (% HHs)	86%			66%			82%
Gave food (% HHs)	66%			67%			84%
Received food (% HHs)	84%			76%			100%
Per capita harvest (lbs)			328.0				871.8
Per capita income (\$)					\$10,078	\$22,031	\$31,809
<i>Wainwright</i>							
HHs employed/harvests (% HHs)	74%			79%			82%
Gave food (% HHs)	46%			70%			84%
Received food (% HHs)	65%			65%			99%
Per capita harvest (lbs)			507.9				704.6
Per capita income (\$)					\$9,095	\$16,710	\$27,820

¹Sample sizes: Wainwright 1977: 87, 1988: 115, 2009: 133, Kaktovik 1977: 63, 1988: 56, 2010: 64

²1977 (Kruse et al. 1982); 1988 (Kruse 1991); Current project 2009–2010

³U.S. Census 1993, Government Printing Office 2003; Current project 2009–2010

⁴Pedersen 1987

comparisons of low, medium, and high ranks) indicated that households with higher incomes were likely to harvest more in Wainwright ($r_{\tau} = .262, p < .001 [N = 133]$).⁴ The relationship in Kaktovik was similar but not significant ($r_{\tau} = .216, p = .058 [N = 64]$). Patterns indicate that high-income households produce more—not less—wild food, but there is heterogeneity in harvest–income relationships.

We explored this heterogeneity by overlaying harvest and income terciles to create nine harvest-by-income groups (Table 4). Most low-harvest households were also low income, whereas most high-harvest households were high income. Seven low-income households in Wainwright and five in Kaktovik were categorized as “high harvest,” suggesting that income is not a necessary condition to be a “super-household.”

Given a market transition, higher incomes would be associated with decreased harvests. Household means and medians across the nine harvest-income categories in the study communities provided no evidence of that pattern (Table 4). Within low- and medium-harvest categories, income–harvest relationships were mixed. But in the high-harvest categories, as mean incomes increased, mean

harvests increased. The association was especially strong in Kaktovik (see online supplementary Figure 2). Households in the high-harvest, high-income category accounted for 85,804 pounds (52.3%) of total subsistence harvest in Kaktovik and 118,019 pounds (42.2%) in Wainwright.

SOCIAL RELATIONSHIPS IN THE MIXED ECONOMY

Figure 2 presents summed flows of food (inflow and outflow of pounds) and contributions (indegree and outdegree of contribution ties) for whales and all other species for the nine income-harvest groups. High-income households were not less engaged in subsistence social relationships than low-income households. High-harvest, high- and middle-income households had the highest outdegree for whale and non-whale food and contributions (Figure 2a–b; see also online supplementary Table 1). High-harvest households with little income provided some food to others. Low-harvest, low- and middle-income households provided some contributions but almost no food, as they had little to redistribute. Low-harvest, high-income households gave little food or contributions, but outflows across other groups were mixed.

TABLE 4. Relationship between Mean Harvest and Income across Nine Harvest-Income Categories for Wainwright and Kaktovik

Harvest x income categories		No. of HHs	Harvest (lbs)		Income (\$)	
			\bar{x}	(median)	\bar{x}	(median)
Wainwright						
Low harvest	Low income	22	21.0	(0.0)	38,127	(40,912)
	Med income	13	147.8	(25.0)	81,113	(82,755)
	High income	9	173.2	(122.0)	134,102	(150,638)
Med harvest	Low income	15	1,065.3	(965.0)	33,037	(34,032)
	Med income	15	1,160.1	(1,014)	78,238	(80,395)
	High income	15	1,083.2	(897.0)	131,375	(123,253)
High harvest	Low income	7	4,813.1	(3,737.0)	34,350	(37,965)
	Med income	17	4,360.2	(3,458.0)	74,850	(73,633)
	High income	20	5,901.1	(4,266.0)	155,545	(143,075)
Kaktovik						
Low harvest	Low income	9	29.0	(3.0)	34,386	(34,671)
	Med income	6	44.0	(29.0)	71,365	(65,851)
	High income	6	30.0	(0.0)	146,084	(133,868)
Med harvest	Low income	5	959.0	(924.5)	24,263	(22,650)
	Med income	9	1,413.4	(1,704.0)	73,595	(74,160)
	High income	8	696.0	(634.5)	126,852	(124,188)
High harvest	Low income	5	3,463.3	(3,337.5)	37,800	(41,323)
	Med income	6	6,452.0	(4,407.0)	85,161	(88,714)
	High income	10	7,800.0	(5,133.0)	123,678	(119,187)

High-harvest, high- and middle-income households also had the highest indegree for non-whaling contributions from other households (see Figure 2c–d). In both communities whaling indegree contributions were low, as contributions go to crews to support bowhead whaling efforts not households. Low-harvest, low-income households in Wainwright received considerably more food than any other group, and in Kaktovik, the second most on average. High- and medium-harvest households received more whale, and active harvesting households, regardless of income, received more non-food contributions than others.

DISCUSSION AND CONCLUSION

In the study communities, elements of mixed economies observed three decades ago—simultaneous household engagements in subsistence, markets, and traditional social relationships—have proven remarkably persistent. Wolfe and Walker's (1987) "super-household" pattern endures.

Both income and per capita harvest have increased through time, and high-income households are disproportionately high-harvest households. Unlike Kirk Dombrowski and colleagues' (2013) findings in a Canadian Arctic community, we found that high-harvest, low-income households gave wild foods to other households (although less than those with high incomes). Our results, however, were consistent with Gurven and colleagues (2015) who found that wealthier Tsimane households in Bolivia gave higher proportions of food to others and had more sharing partners than lower income households. We also found that, on average, low-harvest, low-income households received the most food by weight but also contributed to others, indicating continued subsistence engagement. As Stephen Langdon (1991) and Polly Wheeler and Tom Thornton (2005) noted, significant heterogeneity of choices, roles, and responsibilities observed within these mixed economies belies the simplistic narrative that household subsistence is dying in an inexorable march toward the market.

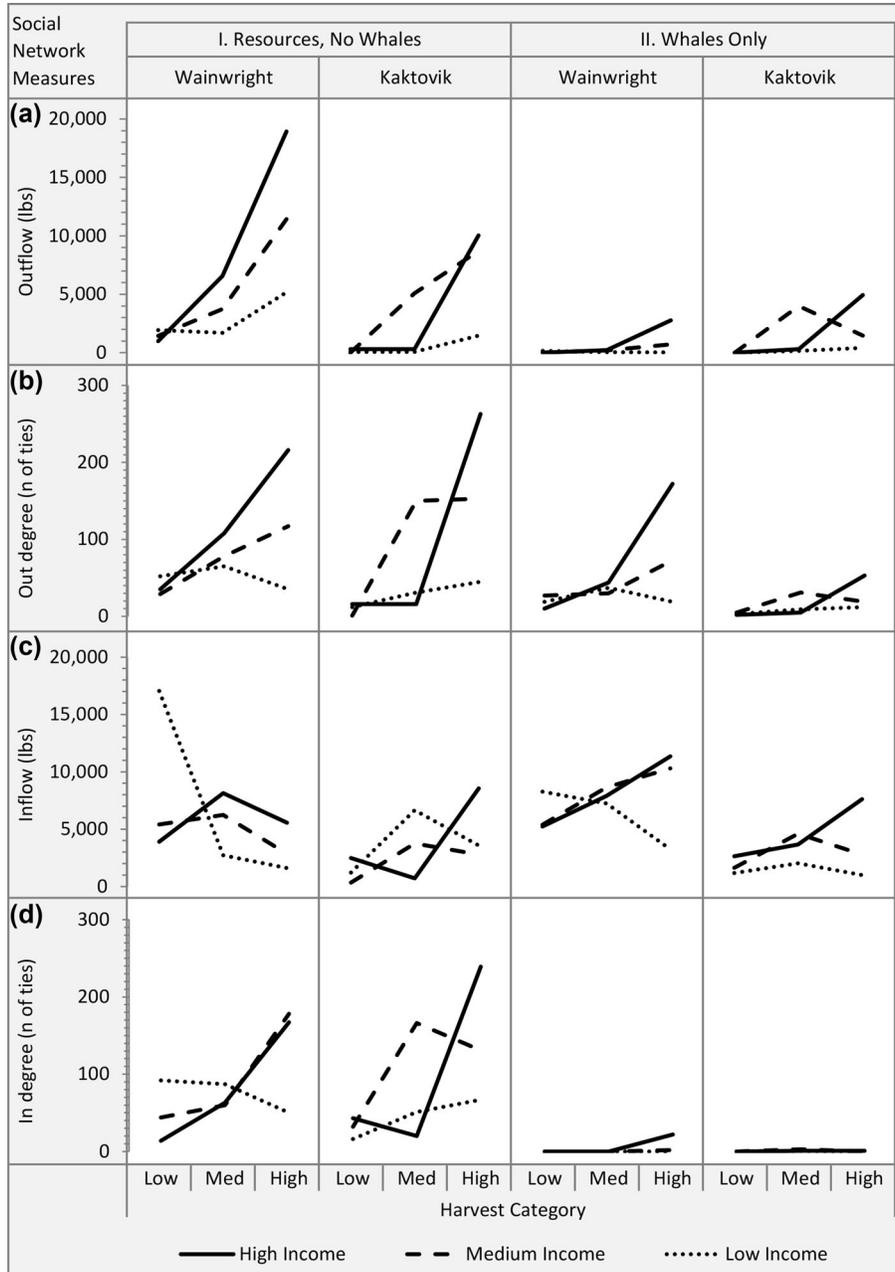


FIGURE 2. The magnitude of social relationship for non-whale species and whales, represented as summed outflows of food and outdegree ties (a–b) and food inflows and indegree ties (c–d) for harvest-income groups. Flows are edible pounds from shares and sharing, and contributions are counts of contribution ties.

The vitality of mixed economies in the Arctic depends—as Alaska policy states—on continued access to bountiful lands, rivers, and seas. Alaska Native communities face many challenges: climate change, subsistence regulation, high costs of imported food and fuel, substance abuse, youth suicide, and transformative technologies. But over the centuries, they have weathered Yankee whalers, epidemic disease, caribou population cycles, and gold miners, not to mention multinational oil companies (Haley 2004). When the state and nation attempted to appropriate Native lands for the Alaska Oil Pipeline, Alaska Natives negotiated a settlement comparable to the “national independence gained by third-world

peoples” (Gaffney 1982:136). Through these upheavals, many Iñupiat maintained strong cultural identities while raising their standards of living, no small feat in a state where “oil and gas development . . . provides roughly 90% of state general fund revenue” (Alaska Arctic Policy Commission 2015:6). Given uncertain Arctic futures, current persistence of Alaska mixed economies does not guarantee their future persistence. Yet market engagement has not persuaded Iñupiat to transition away from core social, economic, and subsistence elements of mixed northern livelihoods. Ultimately, beyond grand narratives of either transition or persistence, a more nuanced consideration of

processes and conditions characterizing mixed economies is warranted.

Shauna BurnSilver *School of Human Evolution and Social Change, Arizona State University, Tempe, AZ 85287; sburnsil@asu.edu*

James Magdanz *School of Natural Resources and Extension, University of Alaska Fairbanks, Fairbanks, AK 99775; jmagdanz@alaska.edu*

Rhian Stotts *School of Human Evolution and Social Change, Arizona State University, Tempe, AZ 85287; rstotts@asu.edu*

Matthew Berman *Institute of Social and Economic Research, University of Alaska Anchorage, Anchorage, AK 99508; mberman@alaska.edu*

Gary Kofinas *School of Natural Resources and Extension and Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK 99775; gary.kofinas@alaska.edu*

NOTES

Acknowledgments. We sincerely thank survey respondents, the Native Village of Kaktovik, the Wainwright Traditional Council, Dr. James Simon and Pamela Amundson (Alaska Department of Fish and Game), and Taqulik Hepa and Mike Pederson (North Slope Borough Department of Wildlife Management), as well as anonymous AA reviewers who provided valuable comments on earlier drafts of the research report. The Bureau of Ocean Energy Management, U.S. Department of the Interior, funded the “Sharing Project” (OMB Control # 1010-0184). Partial support provided by Alaska EPSCoR NSF (#OIA-1208927) and Arctic Social Science, National Science Foundation (ARC-0909570).

1. Whaling activities are unique from other subsistence activities, as they are organized around established crews (bowhead), flexible hunting groups (beluga), and community-wide distribution efforts. Bowhead shares are distributed to crew members, to “crew helpers,” to households at commensal feasts, and among households through sharing. See Bodenhorn 2000 and Kishigami 2013 for a detailed discussion.
2. Human subjects approval was granted by the University of Alaska Institutional Review Board.
3. Alaska residents receive an annual dividend from the Alaska Permanent Fund, supported by oil and gas revenue. The Federal Alaska Native Claims Settlement Act (1971) (43 U.S.C.A. 1601 et seq.) created 12 regional corporations and over 200 village-level corporations that pay annual or biannual stakeholder dividends.
4. Non-local teachers were removed from this and subsequent analyses.

REFERENCES CITED

- Alaska Arctic Policy Commission
2015 Final Report of the Alaska Arctic Policy Commission. Anchorage: Alaska Arctic Policy Commission.
- Bender, Donald
1967 A Refinement of the Concept of the Household: Families, Co-Residence, and Domestic Functions. *American Anthropologist* 69(5):493–504.

Bodenhorn, Barbara

2000 “It’s Good to Know Who Your Relatives Are but We Were Taught to Share with Everybody”: Shares and Sharing among Inupiat Households. In *The Social Economy of Sharing: Resource Allocation and Modern Hunter-Gatherers*. George W. Wenzel, Greta K. Hovelsrud-Broda, and Nobuhiro Kishigami, eds. Pp. 27–60. *Senri Ethnological Series*, 53. Osaka, Japan: National Museum of Ethnology.

Borgatti, Stephen, Ajay Mehra, Daniel Brass, and Giuseppe Labianca
2009 Network Analysis in the Social Sciences. *Science* 323(5916):892–895.

Chabot, Marcelle

2003 Economic Changes, Household Strategies, and Social Relations of Contemporary Nunavik Inuit. *Polar Record* 39(1): 19–34.

Chance, Norman, and John Trudeau

1963 Social Organization, Acculturation, and Integration among the Eskimo and the Cree: A Comparative Study. *Anthropologica* 5(1):47–56.

Dombrowski, Kirk, Bilal Khan, Emily Channell, Joshua Moses, Kate McLean, and Evan Misshula

2013 Kinship, Family and Exchange in a Labrador Inuit Community. *Arctic* 50(1):89–104.

Gaffney, Michael

1982 The Human Resources Approach to Native Rural Development: A Special Case. In *Alaska’s Rural Development*. P.G. Cornwall and G.A. McBeath, eds. Pp. 133–156. Boulder: Westview.

Government Printing Office.

2003 2000 Census of Population and Housing: Alaska: 2002: Summary of Social, Economic, and Housing Characteristics. Washington DC: Government Printing Office.

Gurven, Michael, Adrian V. Jaeggi, Chris von Rueden, and Paul L. Hooper

2015 Does Market Integration Buffer Risk, Erode Traditional Sharing Practices and Increase Inequality? A Test among Bolivian Forager-Farmers. *Human Ecology* 43:515–530.

Haley, Sharman

2004 Institutional Assets for Negotiating the Terms of Development: Indigenous Collective Action and Oil in Ecuador and Alaska. *Economic Development and Cultural Change* 53(1):191–213.

Harder, Miriam T., and George W. Wenzel

2012 Inuit Subsistence, Social Economy and Food Security in Clyde River, Nunavut. *Arctic* 65(3):305–318.

Kishigami, Nobuhiro

2013 On Sharing of Bowhead Whale Meat and *Maktak* in an Inupiat Community of Barrow, Alaska, USA. *Bulletin of the Hokkaido Museum of Northern Peoples* 22:1–19.

Kruse, John

1986 Subsistence and the North Slope Inupiat: The Effects of Energy Development. In *Contemporary Alaskan Native Economies*. Steve Langdon, ed. Pp. 121–152. Lanham, MD: University Press of America.

1991 Alaska Inupiat Subsistence and Wage Employment Patterns: Understanding Individual Choice. *Human Organization* 50(4):317–326.

- Kruse, John, Judith Kleinfeld, and Robert Travis
1982 Energy Development on Alaska's North Slope: Effects on the Inupiat Population. *Human Organization* 41(2): 96–107.
- Langdon, Stephen J.
1991 The Integration of Cash and Subsistence in Southwest Alaskan Yup'ik Eskimo Communities. In *Cash, Commoditisation and Changing Foragers*. Nicolas Peterson and Toshio Matsuyama, eds. Pp. 269–291. *Senri Ethnological Studies*, 30. Osaka, Japan: National Museum of Ethnology.
- Langdon, Stephen J., and Rosita Worl
1981 Distribution and Exchange of Subsistence Resources in Alaska. Technical Paper, 55. Juneau: Division of Subsistence, Alaska Department of Fish and Game.
- Lonner, Thomas
1986 Subsistence as an Economic System in Alaska: Theoretical Observations and Management Implications. In *Contemporary Alaskan Native Economies*. Stephen Langdon, ed. Pp. 15–28. Lanham, MD: University Press of America.
- Medred, Craig
2013 Fuzzy Math of Alaska Subsistence: Too Many People, Not Enough Fish, Game. *Alaska Dispatch*, October 20. Anchorage: *Alaska Dispatch*. <http://www.adn.com/article/20131020/fuzzy-math-alaska-subsistence-too-many-people-not-enough-fish-game>, accessed November 25, 2015.
- Morehouse, Thomas A.
1989 Rebuilding the Political Economies of Alaska Native Villages. *ISER Occasional Papers*, 21. Anchorage: Institute of Social, Economic and Government Research, University of Alaska. http://www.iser.uaa.alaska.edu/Publications/1989_08-RebuildingPoliticalEconomies.pdf, accessed November 30, 2015.
- Murphy, Robert, and Julian Steward
1956 Tappers and Trappers: Parallel Processes in Acculturation. *Economic Development and Cultural Change* 4(4):335–355.
- Nelson, Richard
1969 *Hunters of the Northern Ice*. Chicago: University of Chicago Press.
- Nyman Larson, Joan, and Gail Fondahl, eds.
2014 Arctic Human Development Report: Regional Processes and Global Linkages. Nordic Council of Ministers. <http://dx.doi.org/10.6027/TN2014-567>.
- O'Malley, Julia, and Katie Orlinsky
2015 Alaska's Seal Hunt Lasted Only a Few Days Because It's So Hot. *National Geographic News*, July 1. Washington, DC: National Geographic Society. <http://news.nationalgeographic.com/2015/07/150701-alaska-seals-hunt-climate-warming-kotzebue/>, accessed November 25, 2015.
- Pedersen, Sverre
1987 Unpublished subsistence harvest data for Kaktovik and Nuiqsut. Unpublished MS, Division of Subsistence, Alaska Department of Fish and Game, Juneau.
- Poppel, Birger, and Jack Kruse
2010 The Importance of a Mixed Cash- and Harvest Herding Based Economy to Living in the Arctic: An Analysis on the Survey of Living Conditions in the Arctic (SLiCA). In *Quality of Life in the New Millennium: Advances in Quality-of-Life Studies, Theory and Research*. Valerie Møller and Denis Huschka, eds., Pp. 27–42. *Social Indicators Research Series*. Houten, Netherlands: Springer.
- U.S. Census Bureau
1993 1990 Census of Population: Social and Economic Characteristics: Alaska.
- Usher, Peter
1981 Sustenance or Recreation? The Future of Native Wildlife Harvesting in North America. In *Proceedings: First International Symposium on Renewable Resources and the Economy of the North*. Milton Freeman, ed. Pp. 56–71. Ottawa: Association of Canadian Universities for Northern Studies.
- Usher, Peter, Gerard Duhaime, and Edmund Searles
2003 The Household as an Economic Unit in Arctic Aboriginal Communities, and Its Measurement by Means of a Comprehensive Survey. *Social Indicators Research* 61(2):175–202.
- VanStone, James
1960 A Successful Combination of Subsistence and Wage Economies on the Village Level. *Economic Development and Cultural Change* 8(2):174–191.
- Wenzel, George
1991 *Animal Rights, Human Rights: Ecology, Economy, and Ideology in the Canadian Arctic*. Toronto: University of Toronto Press.
- Wheeler, Polly, and Tom Thornton
2005 Subsistence Research in Alaska: A Thirty Year Retrospective. *Alaska Journal of Anthropology* 3(1):69–103.
- Wolfe, Robert, and Robert Walker
1987 Subsistence Economies in Alaska: Productivity, Geography, and Development Impacts. *Arctic Anthropology* 24(2):56–81.
- Wolfe, Robert, Cheryl Scott, William Simeone, Charles Utermohle, and Mary Pete
2009 The “Super-Household” in Alaska Native Subsistence Economies: A Report to the National Science Foundation, ARC 0352611. San Marcos: Robert J. Wolfe and Associates.

Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Supplementary Figure 1. Comparison of observed and expected harvest-income distributions.

Supplementary Figure 2. Relationship between mean harvest and income across nine harvest-income categories for a) Wainwright and b) Kaktovik. Graphed values represent means for harvest-income groups.

Supplementary Table 1. Calculated means for social relationships for the nine harvest-income categories. Means are calculated based on household flows (edible lbs) and contributions (tie counts).