The Boundary Waters Canoe Area….
Wealth Generator[1]

"…there appears to be no scientific basis for accepting the widespread, 'obvious' assumption that mining will lead to economic improvement (Freudenberg & Wilson, 2002)."

"The wealth of the nation is its air, water, soil, forests, minerals, rivers, lakes, oceans, scenic beauty, wildlife habitats and biodiversity…. In short, that's all there is. That's the whole economy." – Senator Gaylord Nelson

Background

The debate over whether to allow sulfide mining near the Boundary Waters Canoe Area Wilderness turns, as these debates often do, on the question of how many jobs of which types will be created by the activity. What is often lost in the debate, however, is how many jobs and related economic activity would likely be destroyed by the activity.

Key points:

- The economy of the Boundary Waters Region has diversified away from an unhealthy dependence on boom-and-bust extractive industries.
- Key trends reflect the region's natural, recreational, and scenic attractiveness to retirees, vacationers, and workers of all ages.
- Development that threatens those amenities, by making the region less attractive, also threatens the stability and health of the region's established economy.

Northeastern Minnesota is rich in natural resources of many types, but the inescapable reality is that the exploitation of one type of resource – the nickel, copper and other ores lying under lands near the Boundary Waters – will degrade other resources, including water quality, fish and wildlife populations, scenic beauty, forests, and high quality recreational experiences, already on the surface. The jobs associated with these latter resources may be harder to see and some of them may not pay as well as some of the mining jobs. But unlike mining, the economic opportunities associated with a clean environment will stay around for many decades: they'll use the resource over and over without using it up and without fouling it for others.

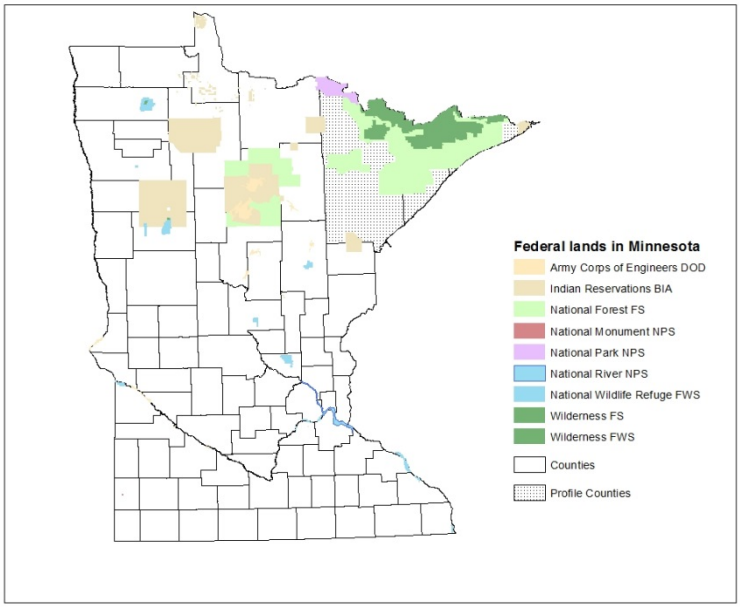
A full accounting of the economic costs and benefits of the mining proposals must include an assessment of what is at stake if the foundation of the region's current economy – the water and air quality, recreational opportunities, scenic value, forested landscape, and other aspects of environmental quality are diminished by mining. The information below regarding the current makeup of the region's economy is a start at that accounting.

[1] Revised, April 2015.

Trends in the Economy of the BWCA Region

- After a steep decline (corresponding to a decline in mining employment) in the 1980s, the population of the three-county region containing the Boundary Waters has rebounded slightly (by about 5,000) (Headwaters Economics, 2014)[2].
- Employment and personal income, meanwhile, have increased steadily since the early 1980s.
- Most job and *labor* income growth has occurred in service industries (a broad category comprising health care, education, recreation and tourism, finance, and others).

Figure 1: Public lands in Minnesota and the three-county Boundary Waters Region

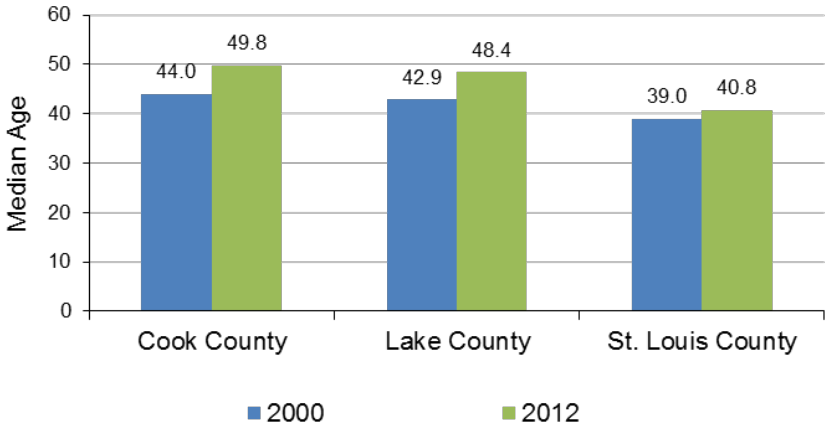


- Trade, transportation, and service industries now employ more than seven out of every ten workers in the region. As measured by employment, the largest of these industries are: Health care and social services; Utilities, transportation and wholesale trade; Retail trade; and Arts, entertainment, recreation, accommodation and food services. (See Figures 4 and 5, below.)
- The region has also seen significant growth in *non-labor* income, especially investment income (dividends, interest, and rent), and age-related transfer payments, such as Social Security and Medicare. Non-labor income grew by 26.3 percent between 2000 and 2012, compared to a 5.6 percent increase in labor income.

[2] Unless otherwise noted, demographic and economic trends information are retrieved using Headwaters Economics' "Economic Profile System" (2014).

- The population is aging (see Figure 2), with large increases in the portion of the population between the ages of 55 and 64 and large decreases in the 35-to-44 age range. (Such trends often indicate the attractiveness of an area to retirees.)

Figure 2: Aging Population in the Boundary Waters Region

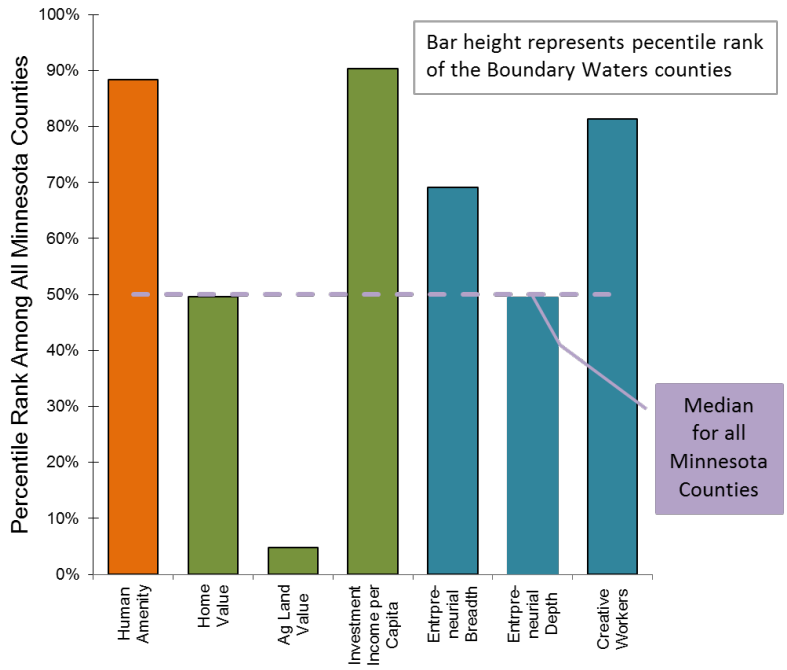


Natural Amenities and Economic Vitality

Many if not all of these trends are consistent with the now-established "supply-side" theory of rural development summarized as "people follow amenities; and jobs follow people." (See, for example, Florida (2000), and McGranahan, Wojan and Lambert (2010). Rural areas do best when they have a combination of a high proportion of creative class workers, a rich entrepreneurial context, and high quality outdoor amenities like an abundance of conservation lands and the clean air, clear water, and recreational opportunities those lands provide (Florida, 2000; McGranahan, Wojan, & Lambert, 2010).

The Boundary Waters Canoe Area Wilderness and the clean water, scenic beauty, and recreational experiences enjoyed there provide that third critical component to a thriving rural economy. This trend is so strong that communities across the continent look to this region as an example of how to do economic development right – that is, how to take advantage of natural amenities without degrading them by overuse or destroying them through incompatible land uses and development.

Figure 3: Assets of the Boundary Waters Region



Based on indicators of "rural assets" developed by researchers at the Federal Reserve Bank of Kansas City, the Boundary Waters region also has many other key ingredients for resilience and success in the new economy (Center for the Study of Rural America, 2003). Figure 3 depicts the percentile rank of these three counties together, relative to all Minnesota counties[3]. The three Boundary Waters counties out-perform most other counties in Minnesota by most of these measures.

Starting on the left, the "human amenity index" for the Boundary Waters region is higher than that of 90% of Minnesota counties. This aggregate quality of life index takes healthcare access, recreational and scenic resources, and the presences of other amenities into account. Next, in green, are three measures of wealth beyond that supplied by wages and salaries. Home values in the region are right in line with state averages, but agricultural land value is much lower. (This is the only measure by which the region falls below the 50th percentile.) Investment income per capita, on the other hand, is very high, exceeding the same measure for more than 90 percent of all Minnesota counties and perhaps indicating the attractiveness of the region to retirees.

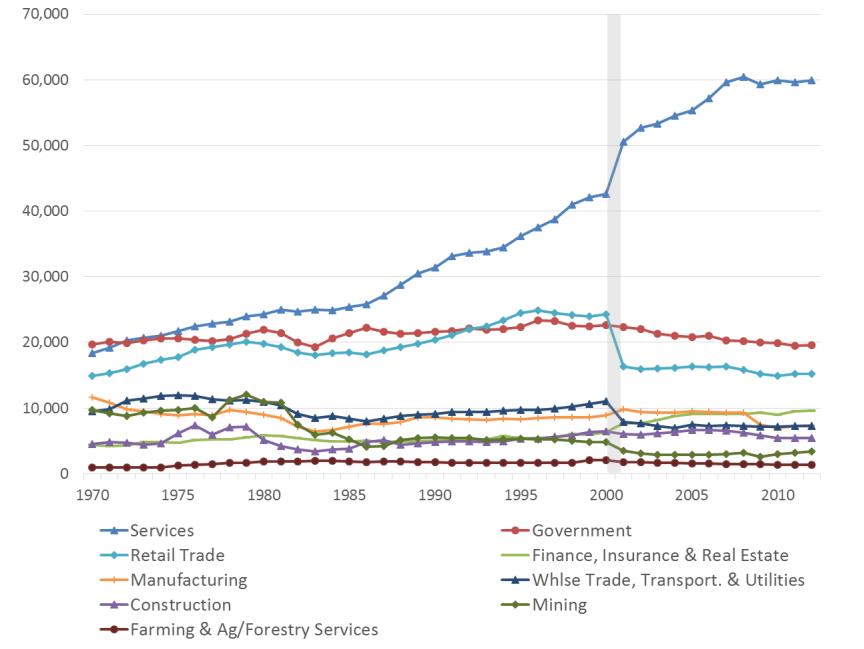
Finally, the blue bars represent the capacity of the region to provide diverse employment opportunities. These rankings indicate the relative strength of the region in Entrepreneurial Breadth (the percentage of workers who are self-employed) and Entrepreneurial Depth (the share of those small businesses' revenue that goes to the owners' income). They show that Boundary Waters region is a relatively good place for small business start-ups and (at the 49th percentile) about as good at keeping those businesses viable as anywhere in the State. The region also has a very high ranking for Creative Workers, which is measured by the percentage of workers in creative professions where many new products and services originate.

[3] Figure 3 depicts the average value of the various rural asset indicators for the Boundary Waters counties normalized according to the values for all counties in Minnesota. Thus, the value shown on the chart indicates the percentage of Minnesota counties with a lower value for each indicator. The percentage for all Minnesota counties is, by definition, 50% for each indicator.

Employment and Income

Consistent with the supply-side pattern of economic development, the region has seen a decline in "goods-producing" employment and income. The goods-producing industries include farming, mining, timber, and manufacturing. This absolute decline is even more pronounced when considered as a change relative to the more rapidly growing "service-producing" or service-related industries. Some of this shift is due to restructuring, outsourcing, and other trends in manufacturing and other industries. Functions ranging from engineering and advertising to accounting and maintenance that were once performed as an employee of a manufacturing or mining firm are now outsourced to firms that, technically, are in the "service" sector.

Figure 4: Employment by Industry, 1970 – 2012



Such change has been happening world-wide for decades. Other shifts that are particular to the Boundary Waters region are likely due to the rise of the region as a destination for nature-based tourism, a desirable retirement location, and simply a good place to live and do business.

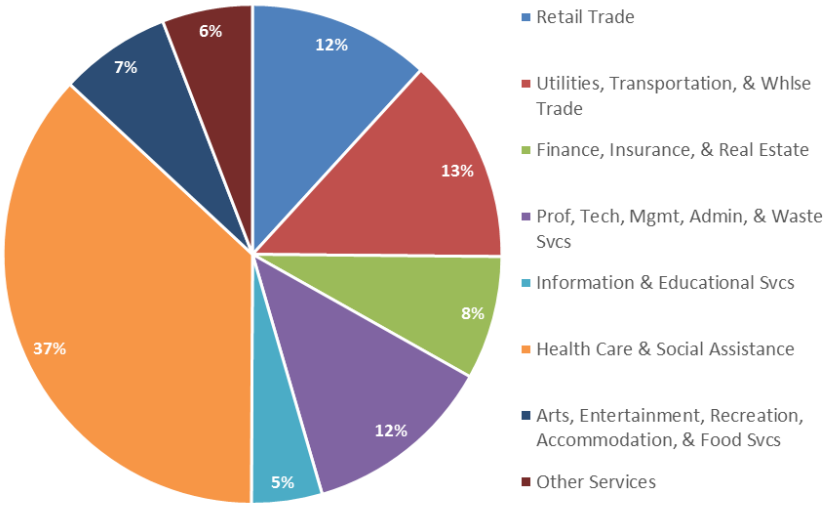
These trends are illustrated in Figure 4, which shows employment by major industries between 1970 and 2012[4]. During this period, mining employment in the BWCA region peaked at around 12,000 jobs in 1979, declined rapidly through the mid-1980s and has remained fairly stable between three and five thousand jobs. Manufacturing employment has declined throughout the

[4] Because of changes in the way industries are categorized, numbers before and after 2001 are not completely compatible. Pre-2001, industries were classified according to the Standard Industrial Classification (SIC) system. Since 2001, industries have been classified according to the North American Industrial Classification System (NAICS). For Figure 4, NAICS industries have been re-classified to match the SIC system as best as possible, but some differences remain. For example, "Information," which is a service industry under NAICS, has been reclassified as "Manufacturing," where important parts of the new Information industry (printing and publishing) resided in the SIC system. One major change for which the BEA employment data cannot be adjusted is in the area of the new NAICS service industry of "Accommodation and Food Services." Under SIC, "Accommodation" had been classified in the major "Services" industry group (as "Hotels and Lodging Places"), while "Food Services and Drinking Places" had been counted in the "Retail" group (as "Eating and Drinking Places").

The bottom line is that some of the kinks in the lines at the grey bar in Figure 4 are due to changes in industry classification, not necessarily sharp changes in employment. Of course, 2001 was the beginning of a mild recession, and some of that kink, particularly in construction, would reflect macroeconomic trends.

period, from a high of more than 11,600 jobs in 1970 to just over 8,900 in 2000 and around 7,300 (after adjustments described in footnote 4) by 2012.

Figure 5: Retail & Service Industry Income, Boundary Waters Region, 2012



Meanwhile, service industries have seen a steep and steady rise in employment since 1970, and the wide-ranging sector now accounts for seven out of ten jobs in the region. Many of these jobs are in health care, financial, and other professional services. Others are in tourism-related industries, like accommodations and food services and recreation services. (See Figure 4 and 5.) (Again, note that some of this shift is structural – the outsourcing of jobs from companies classified as manufactures to those classified as services, but with the ultimate product still being a manufactured good.)

Measuring these changes by income, a similar pattern is evident: retail and services-related industries are responsible for most of the growth in personal income in the Boundary Waters region and account for 60 percent of total labor earnings in the region.

Ecosystem Services: Benefits beyond Jobs and Income

As the words of Senator Nelson suggest above, there is much more to the wealth of the nation, or to a region within it, than what we typically think of as "the economy." There are also the many benefits that accrue to people without ever passing through a formal market. We seldom pay directly for the quality of our air and water, for peace and quiet, or for the opportunity to visit a natural area for recreation or relaxation. Economists, however, are able to infer the financial value of these benefits from the choices people make in the marketplace or by considering what we would have to spend on water purification systems, for example, if nature weren't purifying the water for free.

Using some broad, but conservative assumptions, Esposito et al. (2011) estimated the total value of nature's benefits, or "ecosystem services" produced by all the federal conservation lands[5] in the United States to be more than $262 billion per year.[6] The subset of those lands in the Boundary Waters region (i.e., Superior National Forest and Voyageurs National Park) contributes $1.39 billion of that total. About 86% of this value is concentrated in so-called "regulating services," like cleaning air and soil of pollutants and modulating natural disturbances. Next are "provisioning services" that include the supply of clean water for drinking and industrial

[5] Includes lands managed by the National Park Service, USDA Forest Service, US Fish and Wildlife Service, and the Bureau of Land Management.
[6] This is Esposito et al's estimate for 2009 adjusted for inflation to 2013 dollars.

processes, and raw materials, like timber and minerals. Finally, there are "cultural services" – often hard to measure – that represent the contribution of natural areas to human well-being by adding to human experience through scientific knowledge, artistic inspiration, and recreational experiences.[7,8]

Note that while this estimate, in the "provisioning services" category would include the contribution of mineral resources from this region, it is crucial to consider the other (and potentially much more vast) economic value that could be diminished as a result of mining operations. While a detailed numeric analysis of these tradeoffs is beyond the scope of this report, the following section provides a description of the multiple ways in which hard rock mining presents costs as well as benefits to rural communities.

Economic Consequences of Hard Rock Mining

At least in the relatively near term, mining, including sulfide mining proposed for the Boundary Waters region, comes with economic, social, and environmental costs that must be considered along with potential jobs and income before concluding whether or not mining would be a net benefit for the region. Important lessons from the experience of other communities and regions point to important impacts, including environmental damage and ensuing cleanup costs, spillover effects on established industries, occupational and other health care costs, rising public service costs, social disruption, and the simple reality that a bust inevitably follows an extractive industry boom.

Mine drainage (photo: Northeastern Minnesotans for Wilderness)

Environmental cleanup costs. Mines cause pollution of air, drinking water, rivers, and soils as well as loss of vegetation. According to Boulanger & Gorman (2004), "Modern mining's legacy is more than 10,000 miles of polluted streams, hundreds of contaminated lakes, mountains reduced to craters, and landscapes devoid of life where thriving forests and fragile deserts once existed." Sulfide minerals interact with air and water to release soluble metals, sulfate, and acid mine drainage (Minnesota Department of Natural Resources, U.S. State Army Corps of Engineers, & USDA Forest Service,

[7] Left out of this list (and of the total dollar value reported) are "supporting services." They are left out because the final value of such services as soil formation or navigation are most likely captured in downstream services, like food and fiber provision, recreation and others. Including them could lead to at least some double counting. Therefore, one should regard the estimate provided as a low-ball figure.

[8] These estimates are based on what is known as the "benefit transfer method" of valuing the potential ecosystem services output of land of particular types (wetlands, open water, urban, forest, etc.). (Esposito et al. refine this method by taking into account the baseline health of each area and, thereby, discounting the output of areas that are likely to be less productive.) While not controversial, the benefit transfer method is definitely a first-approximation way of getting at ecosystem service values for a given area or region, and an assessment of the ecosystem services values of the Boundary Waters region in particular would provide different and better estimates.

2013). Waste rock is left exposed to air and water, releasing minerals that had once been kept safely underground. US EPA estimates that such impacts of hard rock mining have contaminated the headwaters of 40% of watersheds in the western United States (Boulanger & Gorman, 2004).

According to a pre-feasibility study for one of the mines proposed for the Boundary Waters region, mining operations would require an average for 4 million gallons of water each day, with most of the water being recycled for use on a later day. Some 800,000 gallons per day, however would be lost either with ores shipped for further processing, or would go with tailings to storage facilities (AMEC E&C Services Inc., 2014). It is the residual process water in the tailings, plus water from precipitation, that poses the risk of acid runoff.

The direct cost of mine cleanup is similarly staggering. In New Mexico, the cost of cleaning up two large open pit copper mines was estimated at over $800 million (Boulanger & Gorman, 2004). In 2004, the U.S. EPA identified 156 sulfide mines that could cost between $7 billion and $24 billion to clean up—a sum that dwarfs the entire annual Superfund budget of approximately $1.2 billion (U.S. Environmental Protection Agency, 2004). Newer estimates from the Agency put the cost of remediation of all hard rock mining facilities at $20 billion to $54 billion (U.S. Environmental Protection Agency, 2009). Particularly when these cleanup costs are borne by taxpayers rather than the mining companies (as is often the case), the long-term financial burden on the public is very large. It is a classic case of market failure in which the ability of the polluters to shift the environmental costs of production to the public means that too much product (in this case the ores and metals) is supplied at too low a direct cost to users.

> "Visitors do not come here to listen to the drone of drills and heavy equipment going on across the lake…. If mining commences, water pollution would threaten our businesses, including dozens of resorts and canoe outfitters."
>
> *Jane and Steve Koschak, Owners, River Point Resort & Outfitting* (quoted in Earthworks, 2014).

Spillovers onto other industries. The cost of cleaning up pollution is only the most obvious and direct cost associated with hard rock mining. Other costs, perhaps as large or larger, appear either as added costs of production for other firms who must take extra measures to cope with the noise, traffic, air and water quality impacts of mining (U.S. Department of Interior & U.S. Environmental Protection Agency, 1998), or as lost sales as the product of those other firms becomes less desirable to consumers. A good example of this latter effect is when mining operations diminish the natural beauty of a region, rendering it less attractive as a destination for tourists, retirees, or anyone seeking to locate and do business or build a life in an attractive, clean, and safe locale (National Research Council, 1999).

As noted above, Northeastern Minnesota's recreation and tourism economy has much to lose. The remote wilderness of the forests and freshwater lakes draws 250,000 visitors annually for canoeing, camping, and fishing, making it the most visited wilderness area in the U.S. According to the U.S. Forest Service the Superior National Forest, within which the Boundary Waters Canoe Area Wilderness is found, is responsible for at least $500 million of local economic activity each

year. Some $100 million of this total comes from the Boundary Waters (Sanders, 2009). The Iron Range Resources & Rehabilitation Board (2011) estimates tourism supports 18,000 jobs, gross sales of $852 million, and $55 million in sales tax revenue across a larger seven-county region. (All dollar values adjusted for inflation to 2013 levels.) The three-county region highlighted in this brief is responsible for $531 million—about 62 percent—of the larger region's gross sales total.

Potential drops in these jobs and income due to loss of scenic and recreational value would be counted among the "opportunity cost"—that is, the value of opportunities forgone when one option or development path is chosen—of hard rock mining. Similar effects could be expected in the timber industry as land is taken out of production and spillover effects in the form of air and water pollution that could affect forest health and productivity.

Another way in which mining could make it more difficult for established businesses is by driving up wages and drawing workers away from other employment (Rothe, 2007). There is nothing wrong with higher wages, other things being equal, but one must consider the longer-term dynamics that could play out with the addition of boom-then-bust industrial development that would disrupt a more steady or sustainable pattern of development in Northeastern Minnesota. Mines can experience temporary shutdowns or periods when operations and employment are cut back (U.S. Department of Interior & U.S. Environmental Protection Agency, 1998). Workers drawn into mining would then flood back in to the labor pool, by which times their old jobs could either have disappeared or been filled.

These cycles and temporary shutdowns cause both economic and social stresses in the area, including via their impact on local businesses. Just as many local businesses could see gains during a boom (due to increased sales of everything from houses to groceries), those same local businesses would see losses during the bust.

> "You want to create an atmosphere that encourages growth, development, [you want] people to move here, people to start their businesses here."
>
> *Kelly Klun, program manager at Incredible Ely* (quoted in Louwagie, 2014).

Impact on longer-term development patterns. However attractive a boom might be, it could erode the ability of the entire economy to develop in the mid- to long run. Here's how.

Other things being equal (like no negative externalities), a higher wage job is better than a lower-wage job. But even then planners are wise to consider the dynamics of what could happen to other opportunities when the boom ebbs. In the parts of Northeastern Minnesota where the economy has successfully diversified away from dependence on resource extraction, many envision a future with sustainable increases in wages paid by firms attracted to the region by its amenities and its talented people (Louwagie, 2014). A mining boom could thwart this vision in the following ways:

1. Workers as well as businesses in support industries (construction, road building, etc.) forgo or postpone education, training, and other longer-term development opportunities and instead take work in the mining industry.
2. Businesses in other industries for which workforce development and other strategies were aimed find that workers and support services are either too expensive or simply unavailable during the boom.
3. Consequently, those businesses choose to locate or expand in (or even move to) regions prepared to meet their workforce and other needs. Some workers may also leave the area to take jobs in the industries for which they had trained.
4. The boom inevitably ends, perhaps too swiftly to have created lasting value for Northeastern Minnesota, but too slowly for other industries to wait for better conditions. The opportunity to attract and retain those other industries has by then passed. Especially if other external effects have taken their toll on the region's natural amenities, it is unlikely that industries offering the same long-term job and income growth could be lured back.

Such a scenario is not speculation but has been borne out by longer-term research. Haggerty et al. (2014), for example, examined the experience of counties across six western states with the oil and gas boom of the 1980s. They found that while the boom initially brought increases in per capita income, "the positive effect decreases the longer counties remain specialized in oil and gas." Moreover, they found that participation in the boom was associated with negative outcomes in terms of higher crime rates and lower educational attainment—precisely the opposite direction required for long-term development in diverse industries.

Health care costs. Hard rock mining is also associated with higher health care costs, both for miners themselves working in a hazardous occupation and in the communities nearby. Vibrating hand tools can affect circulation and neural function in miners' hands, and inhalation of silica dust can lead to lung cancer, bronchitis, tuberculosis, scleroderma, and renal disease (National Institute for Occupational Safety and Health, 1992, 2014; Occupational Safety & Health Administration, n.d.). While from different circumstances, including different occupational safety regulations, there have been some 288,000 cases of compensable silicosis, costing in excess of $2.4 billion, among gold miners in South Africa (Bateman, 2012).

Closer to home, prevalence of lung cancer is higher among hard rock miners (Industrial Disease Standards Panel, 1994). The annual cost of treatment for a single lung cancer patient can range from $8,130 to $60,885, according to the National Cancer Institute (2011). Occupational injuries are another, shorter-term hazard and cost of mining. Lebeau, Duguay, and Boucher (2013) estimate that injuries in mines in Quebec total $130 million per year, or about 5 percent of the mining industry's contribution to GDP. Workers, not mining companies, they note, bear two thirds of the cost of these injuries.

Community members could expect to see negative health outcomes and associated increases in healthcare costs. Exposure to mining byproducts can cause respiratory disease, and acid mine drainage can expose people to arsenic, manganese, thallium, mercury, copper lead, cadmium, selenium, zinc, and nickel. Some of these contaminants are associated with cancer and other serious illnesses (Boulanger & Gorman, 2004; Conservation Minnesota, Friends of the Boundary

Waters Wilderness, & Minnesota Center for Environmental Advocacy, 2012). The human and financial cost of these illnesses clearly must be tallied among the overall economic impact of mining.

Strain on public services. A mining boom could be accompanied by increases in local population, increased wear and tear on roads and other infrastructure, and higher demand for public services such as fire and police protection, education, and other social services (Carter, Oppendahl, & Finnie, 1982; U.S. Department of Interior & U.S. Environmental Protection Agency, 1998). If the expansion of the region's tax base is slower than the increase in the demands for services, local governments' budgets will be squeezed (Power, 2007). Indeed, Power found that copper-nickel mining would generate enough local revenue to cover the costs of development in only one in sixty cases.

Effect on property values. Environmental externalities, both positive and negative, are often capitalized into land prices. Positive externalities, like a pleasant view of, or recreational access to, protected areas like the Boundary Waters Canoe Area Wilderness result in higher nearby property values. Phillips (2004) found that residential property near national forest wilderness areas in Vermont had significantly higher value than otherwise similar properties farther away. For negative externalities like air, water, noise and light pollution that may accompany new mining operations in the Boundary Waters region, the effect would be the opposite. University of Minnesota-Morris researcher Bixuan Sun (2013) estimated that property within two miles of a comparable metal mining operation in South Carolina are 20% lower than they would be without the mine and that property value is diminished by 15% for properties within five miles of the mine.

Social impacts. Somewhat harder to quantify in monetary terms, but no less important, are the social issues that can arise amid a natural resources boom. Communities may be disrupted by the volatile nature of the hard rock mining industry, which leads to decreased community cohesion and change in the character of the population (Power, 2007). Disruptions in community support networks and to families can result, in part due to increases in drug and alcohol abuse within the rapidly changing community (Rothe, 2007).

Rothe also finds that the cyclical nature of mining work can cause additional social problems. Miners often work two weeks on and two weeks off, causing a continual pattern of transition from total separation from their families and communities to total immersion every other bi-week. This work pattern can disrupt social connections and decrease participation in normal community activities.

In addition, mining jobs are disproportionately filled by males, with a partial result that mining boom towns can see increases in both domestic violence and prostitution in the surrounding community (Lahiri-Dutt, 2011). These effects can cause further family tensions, emotional damage, and increased police services to address these crimes.

Cultural disruption. The economy of Northeastern Minnesota and threats to it cannot be characterized entirely from the frame of markets, dollars, or even ecosystem service values as described above. One must also look at the impacts on cultural resources and wellbeing of the

tribes who have known Northeastern Minnesota as home far longer than dollars have even existed. The tribes have expressed concern that traditional or historic properties and areas, such as traditional hunting and fishing sites or ceremonial locations, would be destroyed. Another concern of Native Americans is that sacred locations will be exposed to both visual and auditory blights that would make them unsuitable for spiritual exercises. The tribes have also expressed concern that habitats holding cultural significance in terms of a relationship with nature and wilderness would be destroyed. Environmental degradation could also impact the subsistence fishing, hunting, and gathering (e.g. wild rice, maple sugar) performed by many Native Americans in the region (Bois Forte Band of Chippewa, Fond du Lac Band of Lake Superior Chippewa, Grand Portage Band of Lake Superior Chippewa, Great Lakes Indian Fish and Wildlife Commission, & 1854 Treaty Authority, 2013; Minnesota Department of Natural Resources et al., 2013).

Conclusion

In light of what appears to be the true foundation of the economy of Northeastern Minnesota—that is, a healthy ecosystem and the scenic, environmental, and health benefits that both support the region's residents and beckon visitors and future residents—it seems obvious that the best course for the region is to continue to leverage the region's natural assets into sustainable economic development. At the same time, decisions about development that could undermine that foundation should not be taken without further and careful consideration of what could be at stake and what the true economic tradeoffs would be.

Works Cited

AMEC E&C Services Inc. (2014). *Twin Metals Minnesota Project - Ely, Minnesota, USA - NI 43-101 Technical Report on Pre-feasibility Study*. Retrieved from http://www.duluthmetals.com/s/Reports.asp

Bateman, C. (2012). Silicosis - 10,000 gold miners getting set to sue. *The South African Medical Journal*, *102*(6). Retrieved from http://www.samj.org.za/index.php/samj/article/view/5966/4118

Bixuan Sun. (2013). *Land use conflict in an iron range community: an econometric analysis of the effect of mining on local real estate values and real estate tax collections*. Oral, University of Minnesota-Morris.

Bois Forte Band of Chippewa, Fond du Lac Band of Lake Superior Chippewa, Grand Portage Band of Lake Superior Chippewa, Great Lakes Indian Fish and Wildlife Commission, & 1854 Treaty Authority. (2013). *Tribal Cooperating Agencies Cumulative Effects Analysis: NorthMet Mining Project and Land Exchange* (p. 59).

Boulanger, A., & Gorman, A. (2004). *Hardrock Mining: Risks to Community Health*. Bozeman, Montana: Women's Voices for the Earth. Retrieved from http://www.earthworksaction.org/files/publications/MiningHealthReport_WVE.pdf?pubs/MiningHealthReport_WVE.pdf

Carter, J., Oppendahl, J., & Finnie, B. (1982). *Report to the 48th Montana Legislature on the Socio-Economic Impacts of Large-Scale Hard-Rock Mining*. Environmental Quality Council & Revenue Oversight Committee. Retrieved from http://leg.mt.gov/content/publications/environmental/1982hardrockmining.pdf

Center for the Study of Rural America. (2003). *Regional Asset Indicators*. Federal Reserve Bank of Kansas City. Retrieved from http://www.kansascityfed.org/publications/research/mse/regional-asset-indicators.cfm

Conservation Minnesota, Friends of the Boundary Waters Wilderness, & Minnesota Center for Environmental Advocacy. (2012). *Frequently Asked Questions about Sulfide Mining*. Retrieved from http://www.miningtruth.org/faq-sulfide-mining-minnesota-truth-report.pdf

Esposito, V., Phillips, S., Boumans, R., Moulaert, A., & Boggs, J. (2011). Climate change and ecosystem services: The contribution of and impacts on federal public lands in the United States. In *Watson, Alan; Murrieta-Saldivar, Joaquin; McBide, Brooke, comps. Science and stewardship to protect and sustain wilderness values.* Merida, Yucatan, Mexico.: USDA Forest Service, Rocky Mountain Research Station. Retrieved from http://www.fs.fed.us/rm/pubs/rmrs_p064/rmrs_p064_155_164.pdf

Florida, R. (2000). *Competing in the age of talent: environment, amenities, and the new economy. Report prepared for the R. K. Mellon Foundation, Heinz Endowments, and Sustainable Pittsburgh* (p. 60). Pittsburgh, PA.

Freudenberg, W. R., & Wilson, L. J. (2002). Mining the data: analyzing the economic implications of mining for nonmetropolitan regions. *Sociological Inquiry*, *72*(4), 549–575.

Haggerty, J., Gude, P. H., Delorey, M., & Rasker, R. (2014). Long-term effects of income specialization in oil and gas extraction: the U.S. West, 1980–2011. *Energy Economics*. http://doi.org/10.1016/j.eneco.2014.06.020

Headwaters Economics. (2014). *Economic Profile System*. Retrieved from http://headwaterseconomics.org/tools/eps-hdt

Industrial Disease Standards Panel. (1994). *Report to the Workers' Compensation Board on Lung Cancer in the Hardrock Mining Industry*. Industrial Disease Standards Panel. Retrieved from http://www.canoshweb.org/sites/canoshweb.org/files/odp/html/rpt12.htm#CHAP2-Q1

Iron Range Resources & Rehabilitation Board. (2011, May 6). Northeastern Minnesota jobs, businesses, economy boosted by impact of tourism industry. Retrieved November 27, 2014, from http://mn.gov/irrrb/media/news/news-detail.jsp?id=285-49992

Lahiri-Dutt, K. (2011). *Gendering the Field: Towards Sustainable Livelihoods for Mining Communities*. The Australian National University. Retrieved from http://press.anu.edu.au/wp-content/uploads/2011/07/whole6.pdf

Lebeau, M., Duguay, P., & Boucher, A. (2013). *Estimating the Costs of Occupational Injuries: A Feasibility Study in the Mining Industry*. Institut de recherche Robert-Sauve. Retrieved from http://www.irsst.qc.ca/media/documents/PubIRSST/R-774.pdf

Louwagie, P. (2014, October 19). Ely aiming for a renaissance. *StarTribune*. Retrieved from http://www.startribune.com/local/279680882.html

McGranahan, D. A., Wojan, T. R., & Lambert, D. M. (2010). The rural growth trifecta: outdoor amenities, creative class and entrepreneurial context. *Journal of Economic Geography*, 1–29.

Minnesota Department of Natural Resources, U.S. State Army Corps of Engineers, & USDA Forest Service. (2013). *NorthMet Mining Project and Land Exchange: Supplemental Draft Environmental Impact Statement*. Retrieved from http://archive.leg.state.mn.us/docs/2013/other/130728.pdf

National Cancer Institute. (2011, January). Cancer Prevalence and Cost of Care Projections. Retrieved from http://costprojections.cancer.gov/annual.costs.html#f2

National Institute for Occupational Safety and Health. (1992, August). Preventing Silicosis and Deaths in Rock Drillers. Retrieved from http://www.cdc.gov/niosh/docs/92-107/

National Institute for Occupational Safety and Health. (2014, June 6). Vibration Syndrome. Retrieved from http://www.cdc.gov/niosh/docs/83-110/

National Research Council. (1999). *Hardrock Mining on Federal Lands*. Washington, D.C.: National Research Council. Retrieved from http://www.nap.edu/openbook.php?record_id=9682

Occupational Safety & Health Administration. (n.d.). Silicosis. Retrieved from https://www.osha.gov/Publications/silicosis.html

Phillips, S. (2004). *Windfalls for wilderness: land protection and land vaue in the Green Mountains*. Virginia Polytechnic Institute and State University, Agricultural and Applied Economics, Blacksburg, VA.

Power, T. (2007). *The Economic Role of Metal Mining in Minnesota: Past, Present, and Future*. University of Montana. Retrieved from http://www.mncenter.org/Portals/0/6%20-%20publications/research%20reports/Economic%20Role%20of%20Metal%20Mining%20in%20Minnesota.pdf

Rothe, A. (2007). *Mineral and Coal Resources and the Status of Mining Activities in Western Arctic Alaska*. Anchorake, AK: Halcyon Research. Retrieved from file:///C:/Users/Bonnie/Downloads/2007-09-01-RotheMiningRept.pdf

Sanders, J. (2009). *Supplemental Economic Impact Estimates based on Superior National Forest Management Plan*. USDA Forest Service.

U.S. Department of Interior, & U.S. Environmental Protection Agency. (1998). *Draft Environmental Impact Statement for the Proposed Yamell Mining Project*. U.S. Department of Interior & U.S. Environmental Protection Agency. Retrieved from https://archive.org/stream/draftenvironment00unse_0/draftenvironment00unse_0_djvu.txt

U.S. Environmental Protection Agency. (2004). *Nationwide Identification of Hardrock Mining Sites*. Retrieved from http://www.epa.gov/oig/reports/2004/20040331-2004-p-00005.pdf

U.S. Environmental Protection Agency. (2009). *Identification of Priority Classes of Facilities for Development of CERCLA Section 108(b) Financial Responsibility Requirements*. Retrieved from http://www.epa.gov/superfund/policy/financialresponsibility/cercla108b_07-10-09.pdf

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