The Value of the Internet to Rural Populations: a case study from Mendocino county, CA.

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Top level summary:

- People living in rural areas are frequently left with few (if any) options for Internet connectivity. The Internet services that are available often impose data caps, may be unreliable, often do not provide service at speeds that qualify as ‘broadband,’ and/or are disproportionately expensive when compared to Internet services available in urban areas.

- While throughput speed (aka bandwidth) remains the metric that informs policy and infrastructure grants at the federal and state levels, a variety of factors define Internet connection quality. Throughput speed is not always the top priority among rural residents when it comes to their Internet connection.

- Rural residents use numerous workarounds to manage connectivity constraints, but there is a cost to these strategies including lost time, lost money, and lost sleep.

- Subscribers to a new fixed wireless ISP in coastal Mendocino county on average gained 2.96 new uses of the Internet with their new higher quality connection.

- In response to the evolving economies of rural areas many residents pursue new livelihood strategies that are not based in the natural resource-based industries (farming, fishing, logging) traditional to the area. Telecommuting and telework have a history in the area that predates the Internet. ‘Technologies’ of telework in the past included fax machines and Fedex 2-day delivery. These have given way to Internet-based communication. Notably, 69.5% of survey respondents who are employed reported that the Internet was “very important” to their ability to make a living in the area.

- 45% of employed survey respondents reported that they were self-employed a figure which is much higher than the national self-employment rate of 10%. Self-employment is clearly a key avenue for earning income among rural residents, a strategy of creating jobs where walking into an existing job is difficult. A range of uses of the Internet support rural self-employment. The ability to communicate with distant clients or customers is particularly significant.

- Companies, government offices, and educational institutions increasingly assume that the general population has Internet access and a certain quality of connectivity. For those who lack good quality Internet connectivity it becomes more difficult, in light of these assumptions, to engage with these institutions or to access the services they offer.

- Valued uses of the Internet vary. There are significant subpopulations in the area to consider including – retirees, families with school-aged children, Native Americans, Chicanx/Latinx, and low-income residents. Finally, attitudes toward the Internet vary as well and there are Internet dissenters living in the area as well. In particular there are long expressed concerns about the health & safety of Internet service provided specifically through wireless connections.
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Introduction

While the total population residing in rural areas of the United States has remained stable for nearly 100 years (at around 50 million), the experience of living in rural America is changing. Rural areas in the U.S. are defined by the census bureau as small towns with less than 2500 residents, open countryside and farms\(^1\). In 1900 this figure, 50 million people, constituted 60% of the total national population, a majority. Today less than 20% of Americans live in rural areas. As a result, we might expect the country’s rural population to be increasingly marginalized from policymaking at the state and national level due to their declining proportion of the national population. There have been many other changes to the kinds of economic activities carried out in rural America. Notably, this includes shifts in the agricultural sector and in other types of natural resource use.

![Graph](image)

**Figure 1 - US population: urban vs. rural 1900-1990 (source: US Census bureau)**

Shifting numbers also make the experience of being an Internet non-user different from the recent past. As a technology rises to the point of ubiquity, non-users face increased difficulties.

\(^1\) See definition http://www.hrsa.gov/ruralhealth/aboutus/definition.html
This stems from the fact that the alternative ways of doing things that existed prior to this new technologies arrival gradually disappear\(^2\). For example, many companies now expect customers to contact them by e-mail, chat, or web form and may not provide phone numbers for customer support or may not adequately staff those phone lines. The disappearance of public phone booths as mobile phones became ubiquitous is another example. Several decades after the first consumer Internet services were launched, we are now at a stage where non-use is increasingly disabling. The expectation of Internet connectivity is gradually pervading many domains from banking to government services to education.

Furthermore, the Internet itself is also changing. In 2000, one might get by with dial-up Internet at speeds of 56kbps, but today the contents of the Internet itself are created around higher expectations about the quality of connectivity (i.e. high speed, unlimited data plans, high reliability). In 1995, the average web page was 14 kilobytes, in 2014 it was 1.6 megabytes\(^3\). A small percentage of surveyed Internet subscribers are still connecting using dial-up Internet\(^4\).

\[\text{Figure 2 - Percentage of U.S. adults who are online (1995-2012),}
\text{source: June 2012 stats from the Pew Internet & American Life project}\]

\(^2\) Fischer notes this pattern in his history of the telephone. While the technology began as a novel luxury, over time, non-use became increasingly difficult (Fischer 1992).


\(^4\) dial-up which depends upon landline phone service continues to exist following from the universal service provisions of the communications act of 1934 which ensures affordable rural telephone service. It was updated by the Telecommunications Act of 1996 but something similar has not yet been enacted to ensure affordable access to the Internet.
This study looks in particular at the issue of Internet connectivity in rural areas focusing on a series of small towns along the Mendocino coast, with populations numbering in the hundreds. Residents have long struggled with poor quality or very expensive Internet connections and unreliable or fly-by-night ISPs. Ironically, the area hosts critical infrastructure of the physical Internet, including a number of backhaul fiber optic cables owned by AT&T, and Level 3. The tiny town of Manchester, CA (pop 195) is the site of a cable landing station that connects the West coast to Japan (via Hawaii). For many decades and until very recently, there has been no local access to that capacity. Instead residents have, by and large, connected to the Internet via satellite providers such as HughesNet and Exede.

This report principally describes results from an online survey of subscribers to a new fixed wireless ISP in the area. The survey results are contextualized by a set of 45 interviews carried out between February 2015 and March 2016. In particular, this study seeks to develop a richer account of how Internet connectivity is experienced in underserved areas, particularly in rural parts of the USA. Federal and state policies, broadband mapping programs, and related infrastructure grants, typically reduce quality of connectivity to a single metric: throughput speed (aka bandwidth). However, one finding of this research is that quality is defined by rural users in relation to multiple factors, including reliability (uptime), latency, the existence and size of data allowances, and affordability. Furthermore, the consequences of poor Internet connectivity go beyond simply doing things more slowly online. Some categories of use (such as video streaming, video conferencing, and certain applications of cloud computing) are infeasible with low quality connectivity.

The issue of connectivity must also be contextualized in a broader set of changes taking place in rural America, most notably declining employment in agriculture and natural resource fields. Given that population numbers have remained the same, how are residents in the present day finding ways to make a living? How does Internet connectivity figure into these changes? Are there distinctive needs and uses of the Internet that relate to the particular challenges of living somewhere rural and remote? These questions are addressed in what follows.

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5 See [http://www.ers.usda.gov/media/259572/eib3_1_.pdf](http://www.ers.usda.gov/media/259572/eib3_1_.pdf)
Who lives in coastal Mendocino County and how is it changing?

The Mendocino coast is in certain ways typical of demographic changes in rural areas of the U.S. The coastal towns have maintained a stable population (while urban areas continually grow). Also, typical is the proportionately larger American Indian population as well as the growing Hispanic/Latino population (Johnson and Lichter 2008). Other trends include a shift away from employment in natural resource jobs (agriculture, fishing, logging) into service industries. In Mendocino county in particular, and especially along the coastline, as natural resource employment (particularly in fishing and logging) has declined, employment has grown in other areas, especially in tourism.

However, the story of rural America in transition is not a homogenous one. It is useful to also consider what it is about this area that is distinctive. The towns along the Mendocino coast, because of their immediate proximity to natural beauty as well as their relative proximity to the San Francisco Bay area, draw a population with particular demographics. There is a significant population of retirees and people who own second-homes in the area. These coastal towns, by virtue of land value, access to natural beauty, and scenic oceanfront vistas skew toward the affluent compared to inland areas of the county. Proximity to the San Francisco bay area also means that many residents have (or had) ties to the tech sector. Some might be described as seeking refuge or respite from the tech industry. It is not the case, however, that this area is simply an affluent enclave.

The area of Mendocino county along the coast is rural (by census definitions) but in addition, it is quite remote. ‘Remoteness’ does not have a clear definition, but I will make some attempt to define it and to explain why I highlight this characteristic. The area is about 100 miles from San Francisco (as the crow flies), yet it takes almost three hours to travel there. To get to Point Arena, for example, there are two options: highway 1, a gorgeously scenic coastal highway which is winding and quite perilous in parts, particularly after dark or when the frequent coastal fog sets in. When not crowded with tourists, the road may be blocked by cattle and (especially in winter) by landslides, or flooding. The alternate route along a minor two-lane road from Hwy 128 is equally as winding (if less crowded with tourists). There is no cell phone coverage at all for long stretches. On my first drive up to the area with a car full of students from UC-Berkeley, we had to pull over for two carsick students, one on the way there, another on the way back. The roads --
these thin, tenuous threads of connection to the outside world and to urban centers -- makes the question of Internet connectivity possibly even more pressing in this area. It is not only that resources (for shopping, health, education, jobs) may be limited in the area, but also that getting to these resources is difficult (that is, time consuming, and even physically unpleasant). Road closures, due to flooding or landslides, also make the availability of the roads unpredictable.

Additionally, a kind of left-leaning politics is characteristic of residents. This is, at least, the most apparent public politics of the region (evidenced on discussion lists, Facebook groups, community events, and lawn signs). This runs counter to many other regions of rural America. This political orientation is expressed especially in area residents’ environmentalism and commitment to preserving the natural beauty and ecological integrity of the area. Some residents also hold anti-corporate or more generally anti-establishment views that are not unusual in Western rural and historically “frontier” regions of the country. Furthermore, in the 1960s and 1970s a significant “back to the land” movement brought ‘hippies’ from the Bay area, southern California, and elsewhere who saw this area as a place to make a fresh start away from the dysfunctions of established, urban society. This significant influx of new residents eventually became established, co-existing (sometimes uneasily) with the area’s existing population of “cowboys:” that is, the ranchers, farmers, fishermen, and loggers as well as with the established Native Americans living in the area in bands on numerous small, discontinuous reservations.

According to one part-time farmer I interviewed, coastal Mendocino county is not, in the present day, the most logical place to set up a farm. Coastal land is expensive, the remoteness of this area makes transporting goods (and supplies) relatively more expensive. There is a lack of agricultural infrastructure (two creameries once operating in the area closed down long ago). Those who persist often do so because of longstanding ties to the area (and perhaps also vast inherited landholdings that omit some of the cost-of-land issues), or they find ways to complement farming income with other work, including forms of telework. Some have found niche services related to tourism such as floral arrangements for weddings or organizing retreats for eco-tourists.

The one major exception to the decline in the agricultural sector in the area is the marijuana growing industry. Mendocino county along with Humboldt and Trinity counties form an

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6 for a bit of historical background see Vol. 36 of the Humboldt Journal of Social Relations on “Perspectives on the State of Jefferson”
“Emerald Triangle” widely known for this clandestine industry. Remoteness aids in concealment. Figures on this industry are difficult to arrive at though some claim it’s the areas major industry. For obvious reasons, growers in this community were not (to my knowledge) a part of this study, though there was a great deal of commentary from interviewees nonetheless about the significance of growing – economically, politically, and socio-culturally -- to the area.

**Study Purpose**

The specific questions I asked in surveys and interviews dealt with rural Internet access issues. I sought to examine these issues at a micro (individual and community) level but in a way that would speak to the macro issues (state and federal policy, network design decisions of corporate and government infrastructures, etc). What made this area particularly interesting, as already noted, was the fiber optic cables passing through and yet the absence of direct access. In this sense this case study was of a kind of extreme case, an outlier that may possibly throw into high relief the political and economic aspects of Internet connectivity and illuminate why underserved areas remain underserved. Importantly, the presence of these cables excludes an explanation that geography and remoteness are the primary barriers to connectivity.

The arrival of a fixed wireless ISP (Further Reach) in the area presented another extreme. While fixed wireless ISPs are popular options for serving areas with low-population density, areas that are not served by incumbent providers, this particular ISP was unusual in terms of the depth of technical expertise brought to the design of the network. A number of UC-Berkeley computer science PhDs who have participated in pioneering research on network connectivity in extreme environments were involved in launching the ISP called Further Reach. There was also unusually generous funding to get the network off the ground via a $1 million dollar Google research grant. The peculiarities of this case study allowed a focus on other kinds of struggles and barriers. These struggles are those that remain once upstream bandwidth (total network capacity), start up costs, and technical expertise are cleared out of the way.

The particular research questions I attempt to answer in this study are the following:
1) How should we define ‘quality’ when it comes to Internet connectivity? How does low-quality Internet connectivity shape and limit Internet use? What aspects of Internet connectivity matter the most to users?

2) How does the arrival of high-quality Internet connectivity change the ways people use the Internet in this rural area?

3) Is the Internet becoming incorporated into the way the ‘traditional’ industries (farming, fishing, logging) in the area operate? In light of changing rural economies and declining employment in natural resource industries, how viable and how widespread is telecommuting or telework as a way to make a living in the area? How does the Internet contribute to the way tourism/recreation businesses functions?

4) How does the particular “culture” of this area define distinctive approaches to and uses of the Internet? How does this specifically relate to the areas rurality and remoteness?

**Results of a survey on rural Internet use in Mendocino**

In March of 2016, I carried out a survey of subscribers to the Further Reach ISP, a fixed wireless network that started connecting subscribers in August 2014. The survey design drew from findings in an initial set of approximately 40 interviews. The purpose of the survey was, in part, to get a better sense of the magnitude and distribution of issues and experiences that were described in the interviews. A number of interviewees described workarounds for coping with limitations of their Internet service. For example, interviewees described using the Internet during periods of time when data caps were not imposed (usually very early morning hours such as midnight to 5am), but this lead to another important question, how widespread was that practice? Because the Further Reach ISP had started a little over a year prior to the survey, there was a prime opportunity to do a comparison between the current higher quality and former lower quality ISP services used by subscribers.

The service Further Reach provided was reliably high bandwidth (with average speeds ranging from 8mbps to 60mbps depending on the plan). Notably, they imposed no data caps
whateover. Data caps are monthly limits on data usage that, if breached, result in additional charges or slowed speeds. For Internet subscribers in the area subscribing to satellite, mobile, or the local cable provider CVC, data caps were the norm. The service offered by Further Reach was also low latency (compared to satellite service which the majority of subscribers had prior to Further Reach). This meant certain uses such as synchronous video or online gaming were newly feasible.

**Who responded to the survey?**

The response rate to the survey was reasonably high (37.6%, n=178) likely due to an incentive (a raffle prize) offered to help boost the number of responses. What I include in this report are descriptive statistics to give a broad characterization of the collected data. I did not use inferential statistics and run tests of statistical significance. To understand what these survey results might mean it is also important to consider the demographics of the population that responded in relation to the county as a whole. The respondents to the survey skewed high on income and educational attainment (see figures 1 and 2). That said, the whole coastal area would be expected to show a skew of this sort because the nearby natural beauty commands high prices for property (by comparison to inland areas of the county). The respondents also skewed toward the older age groups, a reflection of the fact that the coastal area is home to a significant number of retirees (see figure 3). One relatively affluent community of (mostly) retirees were connected as early customers for this particular ISP.
Figure 3 - reported annual income of survey respondents

Figure 4 - education completed of survey respondents vs. Mendocino county as a whole
One question is, to what degree is the coastal location of survey respondents responsible for the skewed income/education/age statistics? And to what degree is it the particular ISP surveyed that results in this skew? We can assume that Further Reach subscribers are those most eager and willing to adopt a new technology (and able to afford the cost penalties of breaking an existing ISP contract). Some research suggests that, in general, the self-selecting group of “early adopters” is likely to be more affluent and have attained more education by comparison to those who wait or who do not adopt (Rogers 1995).

The demographics of respondents to the survey reflect some further limitations. In particular, the significant Hispanic population in the area is not represented. The survey was available in English only (and Further Reach offers English-only customer service and support). Only a very small number who self-identify as American Indian responded. To overcome some of these limitations, the interview component of the study entailed more intentionally selecting interviewees to encompass more fully the diversity and range of members of the community. Plans this upcoming fall include a focus group session with members of the Hispanic/Latino community with Spanish-language support.
How should we define the quality of an Internet connection?

From interviews it became clear that apart from bandwidth (aka throughput) speed there were several other characteristics of residential Internet service that were consequential to Internet use. Aggregating the experiences reported in interviews together I define a quality Internet connection as one that: (a) has constant or sufficient bandwidth of no less than 4 mbps that is not affected substantially or frequently by congestion (b) has no data caps (c) has very infrequent and only very brief periods of downtime, and (d) is relatively affordable ($70/month or less with the above qualities). On this last point, it is often the case that rural populations pay somewhat more for what are (measured against these other criteria) poorer Internet connections (Russo et al 2014). Some of the better quality connections available (such as bonded T1 lines or direct fiber optic connections) are extraordinarily expensive. Residents reported paying $500/m for T1 lines though they have quite poor throughput speeds (1.5 mbps). On the upside, a T1 is a dedicated line, so throughput is reliably 1.5 mbps and there is no traffic congestion. A direct fiber optic connection is on the order of tens of thousands of dollars both in fixed upfront costs and monthly fees. Notably, the primary metric relied upon by federal and state-level efforts to map broadband connectivity and to measure and map unserved/underserved areas is bandwidth (throughput) speed. The findings from this survey show that a poor experience with Internet connectivity in rural areas is defined by several other factors beyond throughput speed or even cost. In particular, reliability (frequent network outages), data caps (low data allowances), and latency were big barriers preventing Internet users from making full use of the Internet.

Type of previous ISP

Prior to signing up with Further Reach, the majority of survey respondents (52.8%) subscribed to satellite Internet service (see figure 4). Satellite Internet has some distinct advantages and disadvantages. As for the advantages, satellite Internet service can be provided to customers almost anywhere. It does not require laid cable infrastructure or nearby terrestrial

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7 for the 4mbps figure I’m using the FCC’s older definition of broadband as 4mbps download throughput speed. As time goes on and popular mainstream services available on the Internet demand higher throughput speeds, this figure will need to be changed.  
8 the FCC formally ruled on a definition of “broadband” in 2010 as a minimum of 4 mbps download throughput (1 mbps upload). In 2015 the FCC changed the definition to 25 mbps download throughput speed (3 mbps upload).  
10 See the California broadband availability map - http://www.broadbandmap.ca.gov/
towers to function. In terms of disadvantages, satellite connections have high latency. This is due, in part, to the fact that data must travel a considerable distance to earth orbiting satellites and back to the connecting computer. The result is that applications of the Internet that rely on immediacy (such as synchronous video calling using Skype or networked multiplayer gaming applications) do not function well. Another disadvantage of satellite Internet service is that most providers impose data caps forcing users to think carefully about what data-intensive applications of the Internet they can and cannot use (depending on the size of the cap). A final disadvantage is that weather can affect the reliability of satellite service and in particular heavy cloud coverage and fog, which are very common along the coast, can lead to downtime.

Fixed wireless networks (of which Further Reach is one) were another type of ISP that respondents previously subscribed to. There is little standardization across the fixed wireless industry. For various reasons the previous fixed wireless ISPs in the areas often offered slower bandwidth speeds than Further Reach and imposed data caps. Finally, cellular connectivity, used as a primary Internet connection for a computer, was another common type of ISP. While much of the area along the coast has very poor cellular coverage, there are some pockets of coverage. A significant number of Further Reach subscribers (12.92%) had no Internet service at home prior to subscribing.
Data allowances / Data Caps with Previous ISPs

The significant majority of respondents reported having a monthly data cap with their prior ISP (73.3%) and only 17.5% said they did not (another 9% were unsure). Few urban users in the U.S. are familiar with the experience of having a data allowance (except perhaps for their cell phone service). Exceeding a data cap typically leads to one of two consequences either (a) a per gigabyte charge for additional data usage beyond the cap or (b) service throughput speeds are 'throttled' (that is, slowed down significantly). A common practice is for ISPs to offer certain hours when data use does not count against a data cap. From all reports these hours are scheduled for late night to early in the morning, often midnight to 5am. Its also been reported by users in this area that satellite ISPs that say they offer ‘unlimited’ data plans in fact, throttle throughput speeds once use exceeds the data dap. Responses to additional questions in the survey made clear that Internet service that came with a data allowance produced a range of strategies and workarounds to avoid incurring additional costs.

Now on to some interesting findings that, it should be acknowledged, may have some self-report accuracy problems. As noted, most survey respondents (73.4%) reported having a data
allowance with their previous ISP. This is likely a fairly accurate finding\textsuperscript{11}. However, it is unclear whether self reported data allowance \textit{amounts} can be trusted. I noticed in interviews that people tended to confuse throughput/bandwidth speed figures for data allowances. The reported size of the data allowance for over 50\% of respondents was very low (below 20 GB). If this can be trusted, however, it would explain the most common workaround among Internet subscribers – avoiding or limiting certain uses of the Internet. Data allowances lead users to ration data-intensive applications of the Internet or to avoid those uses altogether. But to highlight the uncertainty in these results, another 30\% of survey respondents who reported that they had a data allowance responded that they were unsure the amount of their data cap.

![Had data allowance with previous ISP](image)

\textit{Figure 7 - had a data allowance (e.g. data cap) with previous ISP}

\textsuperscript{11}Questions about "data allowances" were also rephrased after the survey pilot to further explain what that is
How did Internet users in the area cope with low quality Internet connections?

ISPs may vary in terms of how they are managed and poor connectivity experiences may stem from that, but there are some common characteristics of certain types of ISPs that have a technical basis (such as the high latency experienced with satellite Internet connections). Other variations have to do with business practices. Many fixed wireless networks, for example, operate as small mom-and-pop businesses and these businesses may vary in terms of in-house technical expertise and business savvy. Thus depending on the owners, downtime may be significant. There can also be capacity issues (leading to network congestion) that stem from how the ISP grows adding new customers, how they are obtaining their upstream bandwidth, and how the infrastructure (towers, backhaul, etc) is built out and configured. Small ISPs may close down abruptly, as was the case in a notorious incident on the Mendocino county coast when Esplanade, a fixed wireless ISP, shut down abruptly and without warning in February of 2011 leaving subscribers suddenly without service and with no promise of getting reconnected in the near future.

Subscribers don’t always have a good grasp on why an ISP’s service is poor, whether it arises from technical or economic constraints or from mismanagement. However, they are certainly aware of the different kinds of problems experienced on their end – ranging from unexpected downtime, to problems with slow speeds, to poor video quality (freezing, pixelated images) in chat. Subscribers have come up with a variety of workarounds to overcome these problems.

Workarounds for poor Internet service

Interviews highlighted a number of strategies used by Internet subscribers in the Mendocino coast area to manage and minimize problems of poor quality connectivity. However, a key question was how widespread each of these strategies were and which were most prevalent, questions that a survey was best suited to determine. To answer this question I came up with a list of 6 strategies or workarounds for coping with low quality Internet connectivity (i.e. low bandwidth, data caps, low reliability) drawing from issues brought up in interviews. These were posed as a multiple-choice survey question phrased as follows:
Have you ever done the following to overcome limitations of your previous Internet service (check any that apply)?

- Gone somewhere else (the library, a friend's house) to use the Internet
- Subscribed to a second Internet service (as backup)
- Used the Internet at specific times of day (i.e. late at night when there were no data allowance caps) or avoided using the Internet at certain times of day (when speeds were slow)
- Paid to temporarily upgrade service
- Avoided or limited certain Internet activities (such as watching YouTube videos)
- Made my own repairs or adjustments to equipment (i.e. antennas, satellite dish, cables)

What I found from the survey was that, overall, the experience of engaging strategies to manage low quality Internet connectivity was extremely common:

- **90%** of respondents\(^{12}\) described having used at least one of the above workarounds to deal with limitations to their previous Internet connection
- **63.6%** reported avoiding or limiting certain Internet activities (such as watching YouTube videos)
- **40.2%** reported using the Internet at specific times of day (i.e. late at night when there were no data allowance caps) or *not* using the Internet at certain times of day (when speeds were slow)
- **42.2%** reported going somewhere else to use the Internet (the library, a friend's house)

These strategies or workarounds, in general, are ways of overcoming constraints on existing Internet connectivity, but they come at a cost. These workarounds may involve an extra commitment of time or expense. Where Internet service subscribers avoid using the Internet at certain times of day or avoiding certain Internet activities, at a minimum they are foregoing use at a time that may be convenient, but often are foregoing certain forms of use entirely.

\(^{12}\) 154 survey respondents reported having Internet connectivity at home prior to subscribing to Further Reach. These percentages are out of this total of 154.
In Appendix I, I describe the particular characteristics of an ISP that would lead a subscriber to use one of the listed strategies or workarounds. For example the most common response, that subscribers avoided or limited certain Internet activities could follow from imposed data allowances, low throughput (bandwidth), network congestion issues (which manifest as low throughput), and latency. To explain further, an ISP that imposes a data cap would likely lead subscribers to avoid or limit applications that are data-intensive (such as downloading HD videos, or using cloud-based data backup services such as Dropbox). An ISP that had slow bandwidth (aka low throughput) or network congestion problems would similarly lead subscribers to avoid data-intensive applications, but especially applications such as streaming video. An ISP that had high latency would lead subscribers to avoid or limit synchronous video (such as Skype calls) or network gaming since both require an immediate, non-delayed response to function properly. To cope with these limitations to their Internet connectivity, a fairly common practice among subscribers was to physically relocate to a new place where there was better Internet connectivity – such as one’s workplace, the library, or a friend’s house. I asked further questions about this, in particular to get a sense of the frequency of this practice. Only 22% responded that they did this daily or weekly. However an additional 39% reported doing it at least monthly or every few months. In interviews, I heard from people who frequented a nearby public technology center who would reserve certain Internet uses that required significant bandwidth or consumed a lot of data for days when they were at the center. In some cases this may represent a significant inconvenience. In others, strategic reliance upon multiple locations for Internet access may be part of a daily routine and not register for users as a significant inconvenience.

\[13\] As a side note, a few interviewees reported that having no Internet connection at home was a conscientious lifestyle choice. The survey (which was limited to residential subscribers) was not asking the right population of Internet users to surface further insights into this particular practice. It’s important to note that this kind of intentional non-use and self-imposed restraints on use exists in this area and may be part of a broader, common philosophy among many people living in the area.
What uses of the Internet did subscribers gain once their Internet connectivity improved?

Finally, another way to grapple with the challenges of low quality connectivity is to do a direct comparison between Internet use with low quality vs. high quality connectivity, preferably a comparison between uses by the same group of individuals. Fortunately, the relatively recent arrival of a new ISP (Further Reach) in the area allowed us to do a before and after comparison while the switch was fresh in the minds of subscribers. One question we posed was whether gaining high-bandwidth service with no data caps actually altered Internet use. How many subscribers started using different applications of the Internet after gaining a better quality connection? How many new uses were gained? In the survey a list of 11 uses of the Internet that (in various ways) demanded high quality connectivity were presented. These were uses of the Internet (such as networked gaming and streaming videos) that we knew would be difficult or
suboptimal with satellite Internet or with connections that had strict data caps. We asked respondents to indicate which uses they had been able to do successfully with their prior Internet service. We then asked respondents to indicate which uses they did successfully with their current ISP.

**We found that subscribers added an average of 2.96 new Internet uses after switching to higher quality broadband Internet (n=154).**

The results from the survey show that the most popular new uses were (1) streaming movies or TV shows, (2) watching YouTube videos, (3) using a cloud storage service to backup files (4) using a TV streaming device and (5) listening to Internet radio. Based on interviews, I anticipated that streaming video services such as Netflix would be taken up quickly by subscribers to the new ISP. However other uses, such as Internet radio and cloud storage services, were something of a surprise.

![Internet Uses Added with High-Speed Broadband](image)

**Figure 9 - Internet Uses Added with High-Speed Broadband**
As time goes by the Internet itself changes. Newer uses of the Internet such as watching TV shows on Hulu or making a Skype call are almost impossible for those with poor quality connectivity. Internet companies, computer and mobile device makers, and app builders (not coincidentally based in urban areas) also gradually come to assume consumers are connected at generous speeds and with unlimited data. As a result default settings may include hidden processes that consume data while running in the background or videos set to autoplay. This highlights how little consideration has been made for users who are not connecting in an “always on” or “unlimited” mode. Backup utilities such as iCloud (and other standard features of mobile devices) conflict with Internet services that come with strict data allowances. At a public meeting I attended for residents interested in Further Reach service, I spoke with a resident from Little River who had this problem of data-consumption from hidden background processes. He was subscribed to satellite Internet service with a 10 GB data cap and commented that it was 20 days into the month and he was already over his cap. When he went to diagnose his data use, he realized that his Android phone had been set to auto-backup and when he was at home his phone connected through wifi which led to this unanticipated data use.

**Summary:** In sum, these findings complicate the simple metric of bandwidth speed (aka throughput) used by policymakers. So why is throughput the primary metric if it is such an oversimplification? The reason has to do, in part, with its measurability. Other metrics, such as reliability, are an intermittent problem making it somewhat more difficult to measure. Additionally the use of throughput speed is the result of negotiations between the government agencies and programs that wish to make information about Internet service quality and coverage available to the benefit of the public and the service providers who wish to conceal as much as they can perceiving such disclosure as a threat to their competitiveness. Data allowances are part of service plans, related to cost, and therefore may be protected by ISPs as proprietary.

When survey respondents were asked to rank their priorities, interestingly the aggregated results show reliability (i.e. uptime) coming out slightly ahead of connection speed (bandwidth or throughput) as their primary concern. Having an unlimited data allowance came out ahead of cost (affordability) in the ranking of priorities. Throughput which is the metric currently used by government broadband mapping programs, does not reflect the top priority of residential Internet
subscribers that we surveyed and does not account for the other aspects of their Internet service that frustrate subscribers.

![Ranked priorities when selecting ISP](image)

**Figure 10 - ranked priorities when selecting ISP**

**Adapting to Changes in the Rural Economy**

In rural areas throughout the US, there are ongoing concerns about changing local economies. As noted already, while rural populations remain stable in number, they are rapidly decreasing as a proportion of the total population of the country. We can consider this from two angles, in terms of the ‘glass half full’ and in terms of the ‘glass half empty.’ A ‘glass half full’ perspective would ask whether improved connectivity and information economy jobs (that rural residents connect to remotely) could be a way to revitalize and boost stagnating or dwindling populations in rural areas. From a ‘glass half empty’ perspective, the question to ask is, as constant connectivity becomes the default expectation in urban areas, does lagging connectivity in rural regions begin to harm existing or emerging forms of income-generation? Some examples of this possibility for harm include vacation rentals in the area that have poor (or no) Internet connectivity. While appealing to those seeking respite from connectivity, they may not attract workers in the kinds of white collar jobs who are expected to check in and keep up with business
even during “off” hours (Mazmanian and Erickson 2014). From interviews I found that those working in the tourism industry or with a lot of client/customer contact with people from urban centers sometimes faces hurdles when their clients don’t fully understand connectivity problems in the area and consequently treat unanswered calls and unresponded to emails as unprofessional behavior.

As a counterpoint to this focus on income-generation, there are many people who live without formal or full-time employment in the area, most notably retirees. To some extent rural areas that have a lot to offer such as beautiful natural areas, a laid-back lifestyle, friendly community, and low cost of living may attract large retiree populations. Lichter and Brown (2011:575) refer to these retiree populations as “gray gold.” The Mendocino coast has a large retiree population and the survey responses reflect this. 33% reported that they were retired. The value of such a population is manifold, they pay into the local economy which provides income for the employed segment of the local population without drawing income out of it. They also often contribute significant hours to volunteer efforts and to running organizations that benefit the local community. These volunteer efforts are important given the rural context where formal social services and other forms of infrastructure found in urban areas are absent. To give one example, carpooling arrangements are organized among residents using social media platforms (Facebook, e-mail lists) to arrange trips to urban destinations (Ukiah, Santa Rosa, the Bay Area) given minimal public transportation in the area. To give a concrete example of this from one interview, members of the community used a Google doc spreadsheet to arrange rides for an elderly non-driver after her husband suffered a stroke and was transported to a hospital first in Santa Rosa, then in Fort Bragg which was an hour long drive away. Its also worth noting that there was some pushback to my survey design from retirees who objected to the focus on employment and income-generating activities which they felt omitted uses of the Internet that were valuable to them and that provided value to the community in ways that did not center on income.

Tourism & Telecommuting

Population numbers in the coastal area of Mendocino county has remained stable over the past 100 years. Given economic shifts in the area, specifically, the decline in employment in natural resource reliant industries such as farming, fishing, and logging, what has come in to fill that void? There are two key areas of potential job growth to consider. One, growth in jobs that
draw upon the area’s natural resources, but that minimally extract from or degrade those resources. Tourism, which has seen growth in the coastal area of Mendocino, is one of these growing sectors\textsuperscript{14}. A second possibility is a rise in service, information sector work facilitated by telecommuting or telework. Both possibilities are enhanced by the quality of Internet connectivity in the area.

Internet connectivity facilitates tourism in a couple of self-evident ways. Tourism is, by definition, a business that seeks to attract clients and customers from elsewhere, including distant areas. Connectivity, of course, plays into this. There are at least two possibilities, that: (1) Internet-connected vacation rentals may allow visitors to stay for longer because they are able to keep up with their obligations back home and, (2) businesses serving tourists that are well connected are able to be more responsive to prospective visitors thus capturing their business before competitors do.

Telecommuting and telework was a key focus of the survey distributed to Further Reach subscribers. In particular I was interested in understanding how widespread telecommuting and telework was. I learned in interviews that telecommuting and telework has a long history in this area predating the Internet. Of most notable significant, a booming business employing comic book colorists led by long-time area resident Steve Oliff employed as many as 22 people at one point. The ‘technologies’ of pre-Internet telework (for Oliff’s business and others) included Fedex shipping service, fax machines, and telephone. Notably, residents who did telework often did not start these jobs while living in the area, but were able to negotiate a remote work arrangement after spending many years working on site for a company. Some did this as part of their transition toward retirement.

Telecommuting turned out to be a somewhat difficult concept to define. Many interviews touched on ways of earning income remotely in ways that made the concept more and more ambiguous. For example, does it count as telecommuting if one is self-employed and does not have a physical workplace to travel to? Telework, a word that eliminates the notion of travel to a work destination is perhaps a better substitute. Self-employed people who work from home and mainly communicate with clients and customers via the Internet would be important to include in this

\textsuperscript{14} certainly it should be noted that tourism has its own burdens on the natural resource through pollution (vehicle emissions) and waste so is not without consequence.
study given the concern of this study with ways of earning an income in a rural community where there are limited job opportunities.

Among employed people who responded to the survey (n=105), 54% were employed for wages while 45% were self-employed. This self-employment figure is much, much higher than national figures which indicate that only 10% of Americans are self-employed\textsuperscript{15}. Self-employment is clearly a key avenue for earning income among rural residents, a strategy of creating jobs where walking into an existing job is difficult. Among the employed survey respondents, 65.7% responded ‘yes’ to the question: “Do you ever work from your home in Mendocino county (i.e. telecommute) rather than going to a place of work?” Telecommuting which allows people to live in areas that are a great distance from a physical workplace, or telework more broadly which allows an income-generating activity to be carried out at a distance from clients or customers seem to be the forms most likely to make a difference in the viability of a rural lifestyle. To examine this possibility, in the survey I asked questions about both the frequency of teleworking and the distance to a physical worksite. To get at the heart of the matter, I also asked survey respondents to rate how critical Internet connectivity was to their ability to ‘make a living’ in the area (ranging from ‘not at all important’ to ‘very important’):

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{internet_importance.png}
\caption{How important is the Internet to your ability to make a living in this area?}
\end{figure}

\textsuperscript{15} This figure comes from a 2014 survey by the Pew Research center available at: http://www.pewsocialtrends.org/2015/10/22/three-in-ten-u-s-jobs-are-held-by-the-self-employed-and-the-workers-they-hire/
Among the responses to this question, people earning over $80,000 a year in income reported at the highest rate of all that having Internet connectivity was "very important" (75%). This is not surprising as high-income earning jobs are unlikely to be in abundance in this coastal area. It also suggests that connectivity may make it easier for high-earning people to live in the area with all of the benefits (such as funneling cash into the areas local businesses) and problems (such as rising housing prices and cultural change) that may bring. However even for those earning below $80k a year, a solid 60% reported that Internet connectivity was "very important" to their ability to make a living in the area.

This self-reported valuation of Internet connectivity gives a sense from rural residents themselves that this connectivity is important to their working lives, but how exactly is the Internet employed in income earning activities? Based on insights from interviews, I composed a survey question to ask this more directly. I asked about “the role of Internet connectivity in income earning.” This question was asked of all survey respondents whether or not they reported that they sometimes “telecommute.”

Figure 12 - importance of Internet to income earning (comparing survey respondents who are ‘employed for wages’ vs. survey respondents who are ‘self-employed’)

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Interestingly the responses to these questions differed between those who are ‘employed for wages’ vs. those who are ‘self-employed.’ These two groups can be differentiated in a few ways in terms of how Internet use contributes to income earning. Self-employed people more frequently report using the Internet to communicate with customers outside of the area (77% vs. 45.6% for those employed for wages). Those who are employed for wages are much more likely to report having a physical work site outside of the community (33.3% vs. 22.9%). Self-employed people are also more likely to report that their home is a vacation rental and that they use online platforms (like Airbnb). So where does self-employment fit into the spectrum of rural livelihoods? Self-employment is a way to earn a living in a very limited job market (as the thinking goes, rather than finding a job, you create one). Using the Internet or other communication technologies to build a customer/client base elsewhere overcomes the limited size of the local population. Self-employment also often means flexibility of location and therefore facilitates owning a second home in a rural/remote area which is inhabited only periodically or during certain seasons (and rented out to earn side income otherwise). In interviews I spoke with several writers living in the area who had developed this lifestyle.

Survey respondents were not only asked whether they sometimes “telecommute” but were asked about the frequency and the distance they had to travel to a physical workplace. Some forms of telecommuting (particularly when a workplace is only a short distance away) may not contribute significantly to making rural residency viable. Teleworkers who report frequent teleworking (multiple times a week) and workplaces that are physically distant (i.e. 50 miles or more) represent a group for whom connectivity may be more critical to the viability of their income-generating activities. Sixteen survey respondents (23% of all telecommuters/teleworkers) perhaps qualify as rural ‘telecommuters’ in the purest sense in that they reported both a physically distant workplace and a practice of telecommuting at least weekly.

To summarize the important figures here: 65.7% of all employed people who responded to the survey reported that they telecommute. 62% of these telecommuters do so at least weekly. 33% are long-distance telecommuters (have a physical worksite that is greater than 50 miles away). 29% report that they have no physical worksite to commute to.
### Key figures on telecommuting/telework

<table>
<thead>
<tr>
<th></th>
<th>Value (n=178)</th>
<th>Percentage of Employed People</th>
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<tbody>
<tr>
<td><strong>Employed people</strong></td>
<td>105</td>
<td>59%</td>
</tr>
<tr>
<td><strong>Telecommuters/teleworkers</strong></td>
<td>69</td>
<td>65.7%</td>
</tr>
<tr>
<td><strong>Telecommute at least weekly</strong></td>
<td>43</td>
<td>41%</td>
</tr>
<tr>
<td><strong>Telecommute long-distance (50 miles or more)</strong></td>
<td>23</td>
<td>22%</td>
</tr>
<tr>
<td><strong>Telework (have no physical worksite)</strong></td>
<td>20</td>
<td>19%</td>
</tr>
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</table>

### Relative Value of the Internet: a comparison among technologies

Another useful way of understanding the Internet’s value within this community is to have residents compare it to other information and communication technologies. Survey respondents were asked to consider how difficult it would be to give up each of the following: automobile, Internet, cellphone, television, and landline phone. These technologies were selected to cover a range of needs and uses and a spectrum from old and well-established technologies to newer ones. All are technologies that are general-purpose and fairly ubiquitous, likely to be found in most if not all homes. The automobile outranked the Internet as an essential. This is fairly unsurprising given the remoteness of the community and very limited public transportation options. The Internet was the second most ‘essential’ technology coming in ahead of cellphones. Television and landline phones were more likely to be seen as non-necessities. In fact, 31% of respondents reported that they did not have a landline phone. 17.4% reported that they did not have a television.
It would have been useful to have asked survey respondents separately about 911 availability by landline phone which is tied to AT&T’s obligation to maintain the copper infrastructure in the area, an obligation which AT&T is actively lobbying to end. This survey result suggests many residents may not be actively concerned about public safety and communication infrastructure. However, many policymakers and public safety officials are very concerned, not so much about the necessity of landline service for everyday uses, but in cases of emergency. A hearing was recently held in Mendocino county to discuss this issue with the California Public Utilities Commission (CPUC). My survey results perhaps reflect that public awareness campaigns may be needed particularly since 911 routing is handled quite differently for cell phone service, because cell phone service is spotty in the area and many residents don’t have coverage at home, and because cell phone service is less robust in the face of electricity outages than landline phones.

16 Press release about this meeting here: http://www.co.mendocino.ca.us/administration/pdf/07-13-2016_CPUC_Press_Release_with_Updated_Agenda.pdf
Important subpopulations

While the survey generated a large number of responses that are designed to be comparable, they represent a subset of the area’s population, those who subscribe to Further Reach. The necessity of asking the same questions of all survey respondents means that the experiences of important subpopulations cannot be addressed in much depth. The interviews my students and I carried out were meant to be complementary as a way to better encompass the range and diversity of people living in the area. These interviews informed the questions asked on the survey, but they also illuminated topics specific to individuals and specific to particular subpopulations in the area. While the survey results focused on general experiences that all Internet users in the area can speak to, in this section I point briefly to some of the special issues, needs, and uses of the Internet of important groups living in the area.

Native Americans

There are several Native American reservations in Mendocino county. Some tribal members live on one of the nine, small reservations (called “Rancherias”) which are home to distinct bands of Pomo and Cahto Indians (Laytonville, Manchester/Point Arena, Pinoleville, Round Valley, Redwood Valley, Sherwood Valley, Coyote Valley, Guidiville, and Hopland). According to Sal Martinez a member of the Manchester band of Pomo Indians who has also researched tribal history extensively, the term “Pomo” has come to encompass cultural groups with quite different practices and systems of governance. Many others live off the Rancheria, some in nearby towns and some further away such as Santa Rosa altogether constituting a diaspora. My comments about the Native American population in the area are based on a handful of interviews with members as well as recordings from the local community radio station KGUA which often highlights public voices from the tribal community (including Eric and Karen Wilder, Lori Laiwa, Sal Martinez, and Isaac Rios). There are several issues I have been able to understand from these conversations about information access and Internet connectivity that pertain specifically to the local Native American population.

17 According to Sal, the complete way to refer to this particular group is the Manchester band of Pomo Indians of the Manchester/Point Arena Rancheria
18 KGUA is run by station owner/manager Peggy Berryhill (a Muscogee tribal member) and a pioneer in the field of tribal media
On the matter of information (abstracted from the particular mode of connectivity), like many long oppressed indigxenous groups, in this case the descendants of survivors and victims of genocide, there is a justified reticence to open up cultural heritage or tribal business to non-tribal audiences. However, there are various ways in which members of the tribe suggest the Internet has been or promises to be valuable to them specifically in relation to their tribal identity or tribal membership.

*Improving transparency of tribal governance to tribal members:* One proposal by tribal member Bernadette Smith, as part of her campaign running for tribal secretary, was to build a password-protected website for tribal members to link together the Pomo diaspora. This proposal, which was documented in the local newspaper, the ICO, and on KGUA, was intended to allow those living off of the Rancheria to be informed about and weigh in on matters of tribal business, and to improve overall transparency of tribal governance proceedings.

*Pursuing self-education on tribal history:* The Internet can also serve as a source for Native Americans to pursue self-education about tribal history, cultural practices, and the political history of relations between Native America from the beginnings of European colonization to the present. It can be an important source for current events as well pertaining to Native America including events that threaten or that uphold tribal sovereignty (see Indianz.com). In the context of limited exposure to this history in public schooling, the Internet is an important source for those tribal members who are motivated to learn more.

*Tribal empowerment and cultural reclamation:* There is a recognized value to speaking to a broader audience outside of the tribe and Internet connectivity as part of campaigns around public awareness. The recent campaign to restore the Garcia River to its prior Pomo name – P’da Hau – led by Isaac Rios and Sal Martinez involved approaching several agencies and convincing elected officials to support the effort. It also involved gaining support from various tribal agencies. Given the dispersion of the various Rancherias in the county, Internet connectivity was critical for looking up contact information, sending e-mails, and distributing documents. Another desired effect of the P’dahau renaming effort, according to Sal Martinez, was to raise awareness within the tribe counteracting cultural erasure, make a public effort toward cultural reclamation, and spark conversations between members of the tribe and non-members ultimately as a way to boost a sense of Indian empowerment.
Protecting tribal sovereignty: In a general sense, the matter of tribal sovereignty, the self-governance of tribes promised by the U.S. government, but often violated, is far from a settled matter. Online platforms are part of the ongoing fight to preserve tribal sovereignty by helping to share information, build solidarity and awareness, and take action.

Chicanx/Latinx

Like many areas of the rural United States, the Latinx population is growing while the overall population remains static. In Mendocino county, in particular, population growth can be wholly attributed to the increase of this particular population. For those who are first generation immigrants, one particular use of the Internet relevant to this group is using the Internet to connect with family back home in Mexico\textsuperscript{19} or wherever else family may reside. With good quality Internet connectivity, immigrant families were able to do video chat, in some cases laying eyes on family members for the first time in years. Additionally hometown groups organized on Facebook to provide support (often financial) to the community back home, forms of online remittances, and hometown or regional radio stations allow for many modes of engagement and connection with one’s place of origin.

\textsuperscript{19} Migration patterns draw populations primarily from Mexico, but can also include residents that are from other parts of Central and South America.
Students

For K-12 students in the area, homework that requires Internet connectivity to complete begins around 7th grade. For low-income families or families that simply choose not to have Internet connectivity at home, pressure from the school is frequently the impetus to subscribe to a residential Internet service. They may do so reluctantly. For families with limited income, naturally this generates worries over having to pay yet another bill. Several interviewees reported that alternatives to connecting from home (that generally required that they sacrifice break time at school to do this work) seemed punitive. They noted that children may not admit to teachers that they don’t have Internet connectivity at home out of embarrassment, but will suffer the consequences to their grades of failing to complete assigned work. In urban areas served by large incumbent Internet service providers, families with K-12 children often have the option to subscribe to low-cost Internet services that charge merely $10/month (i.e. Comcast Internet
Essentials) by demonstrating low-income status. However, these programs do not reach rural areas which typically aren’t served by these incumbents.

In terms of post-secondary education, there are no institutions of higher education in the immediate area. This means that continuing in school will involve either long commutes (of two hours or more) or relocating out of the area. There is interest in online degree programs among residents in the area as a way of pursuing further education without having to bear the extra burden of time and cost related to traveling to institutions of higher education. In two interviews with individuals who had pursued online programs, connectivity issues did prove challenging, but this was not ultimately the primary barrier to program completion for either student. Rather the isolation of pursuing an online course, competing demands on time, and difficulties in communicating and negotiating with professors at a distance were more significant barriers.

**Traditional Industries**

Mendocino counties booming timber and fishing industries have been in a long trend toward decline. Farming has also changed and evolved. The area’s dairy business still exists, most notably at the Stornetta Ranch which produces diary products sold widely under the Organic Valley brand. Without a substantial agricultural industry, there is a lack of infrastructure. One wife of a farmer whom I interviewed reported that her husband often lamented the lack of a creamery. Two creameries, one located in Manchester, one in Point Arena closed down long ago. Many of the farms in the area are smaller in scale and rely on supplemental sources of income, serve niche markets, or combine farming with rising industries like tourism. The coastal region, while appealing as a place to live, is not the most practical location to start a farm for the financially-minded according to one part-time farmer I interviewed. He added that, were he to do it again, he might pick a location closer to Petaluma, an area with cheaper land, better infrastructure, and easier access to retail markets. The illicit marijuana growing industry, by contrast, has been booming in the area for decades now. The remoteness of the area serves the industries need for concealment well. Many point to the "hippies” who relocated to the area and the “back to the land” movement as creating and growing this industry. As farming proved to be an extremely difficult business to walk into, marijuana emerged as a lucrative crop rewarding those who developed niche expertise to grow particular varieties.
The Internet, however, is still relevant to traditional industries in several ways. It can serve as a platform for reaching out to customers and communicating availability of goods for those selling to retail markets (see, for example, see the Arana Cove Fish or the F/V Princess Facebook pages). From my conversations with people in these industries, I did not find that regulatory requirements and the paperwork involved (which many reported to be growing over the decades) necessitated use of the Internet. Rather better Internet connectivity improved convenience and efficiency. For example, it facilitated the speedy ordering and delivery of specialized parts for equipment. And as one farmer noted, “our margins are slim so efficiency is key.”

**Low-income subscribers**

Separating out lower income ($80k and below) households from higher income ones did not yield dramatically different responses in the survey results. Unsurprisingly affordability of Internet service went up in the priority rankings for lower income groups. A challenge faced by low-income households is that residential Internet costs more in this rural area and for a lower quality service. Furthermore, additional costs may be incurred by exceeding data caps which, for many, were a nasty surprise on the monthly bill. In low-income households, an Internet connection may be shared by several households which makes managing and staying within data allowances even more difficult.

It is generally the case that households with lower levels of education and lower-income levels (which are themselves correlated) are also less likely to subscribe to residential Internet services and are more likely to have Internet connectivity only through their mobile phones (Pew Research Center 2013). An Internet service subscription that is separate from mobile phone service is yet another network connectivity bill. So it is unsurprising that low-income households would be reluctant to add another bill to their financial burdens. In some cases, as noted already, pressure from the school (for households with school-age children) forces the issue. Some low-income households find a very compelling use they had not anticipated that seems to justify the added expense, sometimes by eliminating other bills (i.e. for satellite TV service, international calling cards, or excess data charges).

Because low income households are more likely to rent rather than own their homes their landlords willingness to install equipment (satellite dishes, antennas) that will provide Internet connectivity could be a contentious issue, although I heard of only one purported incidence of this.
The kinds of ISPs that often serve rural areas and may be the only service available (specifically satellite and fixed wireless) require that equipment be mounted on a building, tree, or tower on the property where the subscriber resides and this equipment varies in size and obtrusiveness depending on a number of factors.

**Dissenters**

This group is defined by a general attitude of skepticism, resistance, and rejection of Internet connectivity, but within the group one finds several different attitudes toward technology. In general, it is inadequate to define them by the usual shorthand as people who ‘fear’ technology, who are traditional, who fear change in general, or by a common colloquialism as ‘luddites.’ In a program on the local NPR affiliate KZYX that tackled the subject of the “rural digital divide,” one caller left the following message about what he anticipated would be the unfolding consequences of improved connectivity,

“we need to have places where you can not get TV, where you cannot get cell phone, and where you cannot receive computer link to the Internet. Those places need to stay like that. If you want to have more people in this county and turn a rural place into a place where there’s a lot of people, then bring on the broadband cause that’s what its gonna do. Next thing you know, your gonna have neighbors.”

This comment takes the view that the sacrifices one makes to live in the area is what keeps it rural and that the ability to escape relentless human contact is why some choose to live there. To improve connectivity is to potentially face an onslaught of new residents. Nothing in this particular comment, however, suggests that Internet use, in and of itself, is harmful.

A merging of remoteness, poor connectivity, as well as environmentalist, and anti-corporate sentiment also may partly explain a preponderance of people concerned with health and safety risks of wireless infrastructure as well as people who experience wireless (EMF) sensitivity. These concerns appear in discussions on community mailing lists and are voiced in community meetings including public meetings with service providers and with elected officials. Among broadband proponents and others working to realize improved connectivity, people with such concerns are often derided as the “tin-hat crowd” a phrase fully intended to cast doubt on the psychological stability of these critics. My own efforts to communicate with people suffering from EMF sensitivity have led to a number of dead ends and a couple of tense exchanges in person and
on email laced with suspicion about my intentions and affiliations. What I can say from talking to a very limited number of people (only 2 in much depth) is that EMF sensitivity does not necessarily coincide with general anti-technology sentiment. In fact Internet connectivity can play a role in researching the condition itself and obtaining equipment and specialized clothing to improve the comfort and mobility of folks who are afflicted. Concerns about EMF are specifically directed at wireless, that is, a particular manifestation of the physical infrastructure of connectivity.

In terms of dissenters commenting on the actual use of the Internet, I found two views in my conversations with individuals. One has to do with what as perceived as the ‘dark side’ of the Internet: porn, sites promoting right-wing, extremist ideologies, and other forms of disturbing content. That these materials are available, especially to adolescents in the community, is a concern among parents. The other concern has to do with the overall addiction and appeal of being connected as potentially leading people to become more and more disengaged from their face-to-face community. Many point to the intimacy and supportive familiarity of small-town living as a distinctive advantage of residing in this area. I’ve interviewed several community members who appreciate and benefit from Internet connectivity, but also conscientiously sequester their time online to a particular time and place. Often this means having no residential Internet connection, but visiting the library to check e-mail and do other things online.

**Conclusion**

This report has attempted to look at what about the experience of living somewhere rural and remote might necessitate Internet connectivity. I have taken a different approach from the literature on the “Digital Divide” which generally focuses on ascertaining differences comparatively between rural and urban areas simply in terms of the degree or quality of access. What a conventional focus on the ‘Digital Divide’ leaves out is the possibility that the Internet has distinctive and unique value to rural Americans in a way that relates to their rurality. Additionally, this study included some consideration of quality of access and the workarounds users develop to cope with specific challenges of low-quality access.

In Mendocino county certain distinctive and notable uses characterize Internet use. In this report I pointed especially to uses that were oriented toward the changing rural economy. The economic shifts away from some forms of employment (particularly agricultural and natural
resource jobs) may be countered by the new possibilities for telework or telecommuting. While this study was not longitudinal and cannot provide evidence of growth in telework, it is clear from the survey that, among subscribers to this new fixed wireless network, teleworking is widespread. The perception among these teleworkers is that connectivity is what allows them to remain living in the area where job openings are limited. Additionally, in an area lacking formal social services infrastructure comparable to what is found in urban centers, the use of the Internet has become a key part of self-organizing. For example, community mailing lists are used to arrange rides in an area with limited public transportation. Volunteering in this community is critical to the support of the library, activities for seniors, and fundraisers and the Internet has become integrated into this organizing.

Rural areas also are home to a number of important subpopulations. Native American lands are rural lands. Some of the uses of the Internet that relate to tribal solidarity and tribal sovereignty discussed in this report therefore characterize rural Internet use. Dissenters and especially people concerned with wireless health and safety are not exclusively found in rural areas, but by virtue of the 'clean' air (relatively free of EMF waves) rural areas draw such individuals. More broadly conscientious non-users of the Internet are part of this rural community often bringing to the fore certain values that are important to these communities, not only to non-users but to those who embrace Internet connectivity as well.

Finally, this report calls for more holistic consideration of the quality of Internet connectivity. While digital divide research often considers access in binary terms (user or non-user, connected or disconnected) confronting the broad range of network technologies that one finds in rural areas where incumbent providers do not dominate brings forward a number of other quality concerns. In addition to bandwidth (throughput speed), reliability was a critical matter, low data allowances altered and constrained Internet use, and latency problems (experienced by satellite Internet use which is prevalent in rural areas) prevented the use of certain popular applications. Surveyed residential Internet subscribers who had recently acquired a high quality connection (high throughputs speed, no data caps, low latency) gained an average of 2.96 new uses of the Internet. Therefore better connectivity holds the promise of altering practices of Internet use, not simply making Internet use a bit more efficient. By considering the experienced consequences of poor quality as well as high quality Internet access on rural residents, my hope is that this report can contribute a firmer basis and stronger justification for policy-making, grant
allocation, and advocacy efforts to address issues of equitable access that affect rural areas of Mendocino county and the country as a whole.

Acknowledgements

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References


## Appendix I

### Type of Service

<table>
<thead>
<tr>
<th>Type of Service</th>
<th>Reliability</th>
<th>Latency</th>
<th>Capacity (Traffic)</th>
<th>Insufficient Throughput</th>
<th>Low Bandwidth</th>
<th>Data Allowances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satellite</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dial-up</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Wireless</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cellular (3G/4G)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
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<tr>
<td>T1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSL</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

= Sometimes an issue for this type of service
### Issue (in columns) = The workaround practice (in rows) is a way of coping with this

<table>
<thead>
<tr>
<th>Issue</th>
<th>Workaround</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoided or limited certain Internet activities (such as watching YouTube videos)</td>
<td>63.60%</td>
</tr>
<tr>
<td>Used the Internet at specific times of day (i.e., late at night when there were no data allowance caps)</td>
<td>40.20%</td>
</tr>
<tr>
<td>Used the Internet at specific times of day (as backup)</td>
<td>42.20%</td>
</tr>
<tr>
<td>Subscribed to a second Internet service</td>
<td>30.50%</td>
</tr>
<tr>
<td>Paid to temporarily upgrade service</td>
<td>10.40%</td>
</tr>
<tr>
<td>Went somewhere else (the library, a friend's house)</td>
<td>8.40%</td>
</tr>
<tr>
<td>Made my own repairs or adjustments to equipment (i.e., antennas, satellite dish, cables)</td>
<td>8.40%</td>
</tr>
<tr>
<td>Respondents who used this workaround (%)</td>
<td>Low data allowances (throughput network congestion)</td>
</tr>
<tr>
<td>8.40%</td>
<td>Reliability</td>
</tr>
<tr>
<td>10.40%</td>
<td>Latency</td>
</tr>
<tr>
<td>14.40%</td>
<td>Throughput</td>
</tr>
<tr>
<td>30.50%</td>
<td>Bandwidth (to equipment upgrade)</td>
</tr>
</tbody>
</table>
| 40.20%                                                              |                         = the workaround practice (in rows) is a way of coping with this issue (in columns)