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ANALYSIS

The contribution of built, human, social and natural capital to quality of life in intentional and unintentional communities☆

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ABSTRACT

Ecovillages, co-housing communities, and other types of intentional communities (ICs) have proliferated in recent years. There are currently several thousands of these communities worldwide and their numbers are increasing rapidly. We surveyed a subset of these communities to learn more about their characteristics, including their world view or vision, the status of four basic types of capital (built, human, social, and natural), and the quality of life (QoL) they provide for their residents. Survey results indicate that ICs have a better balance between built, human, social, and natural capital than unintentional communities (based on a parallel survey of neighborhoods in Burlington, VT, USA) and that this results in a higher QoL among residents. It is difficult to assess the sustainability of ICs, but the data indicates that within ICs, social capital is substituted for built capital thereby reducing the level of material throughput.

1. Introduction

As the world grapples with its dwindling natural resources and attempts to reduce some of the pressure on the planet's waste absorption systems, it is clear that humans must forge new paths that attain a high quality of life while consuming fewer resources. The era of profligate consumption will come to an end, and this transition will be both more enjoyable and more feasible if it does not entail a dramatic reduction in people's quality of life. To this end, an ability to successfully replace built capital with social, human, and natural capitals could prove quite important. A recent survey of residents in 30 different intentional communities (ICs) combined with results from a similar survey conducted in Burlington, Vermont, suggests that the alternative living patterns being crafted by these communities may be demonstrating one method for reducing our reliance on built capital and its associated throughput of resources and waste. Our results imply that ICs successfully substitute social capital, and to a lesser extent human and natural capital, for built capital indicating a more sustainable path to a high quality of life can be had.

2. Background

Efforts to explain well-being or quality of life have a long history, but there has been an explosion of interest and activity in recent years. Easterlin (2003) identifies two main strands of prevailing theory in psychology and economics. The dominant theory in psychology has been the "set point theory"

(Lucas et al., 2003 is a good recent review). This theory hypothesizes that each individual has a happiness set point determined by genetics and personality to which one returns after relatively brief deviations caused by life events or circumstances. At the community level, this theory would imply that the level of subjective well being (SWB) across communities should not be affected at all by factors such as income, health, education, environmental amenities, etc., but should be purely a function of the genetic make-up of the population.

The dominant theory in economics has been that "more is better" (Samuelson, 1947; Varian, 1987). This theory implies that levels of income across communities should correlate with SWB. Easterlin (2003, p. 11176) argues that "neither the prevailing psychological nor economic theories are consistent with accumulating survey evidence on happiness." He argues that because of hedonic adaptation (people's aspirations adapt to their changing circumstances) and social comparison (people judge their happiness relative to social peers rather than on an absolute scale) that both the "set point" and "more is better" theories fail. Easterlin shows that SWB tends to correlate well with health, level of education, and marital status, and not very well with income. He concludes that

> People make decisions assuming that more income, comfort, and positional goods will make them happier, failing to recognize that hedonic adaptation and social comparison will come into play, raise their aspirations to about the same extent as their actual gains, and leave them feeling no happier than before. As a result, most individuals spend a disproportionate amount of their lives working to make money, and sacrifice family life and health, domains in which aspirations remain fairly constant as actual circumstances change, and where the attainment of one's goals has a more lasting impact on happiness. Hence, a reallocation of time in favor of family life and health would, on average, increase individual happiness (p. 11182).

Previous international comparisons of subjective well-being have focused on cultural differences in the acceptance of positive and negative emotion, income, individualism, human rights, societal equality, political stability, and interpersonal trust (Diener and Suh, 1999; Diener et al., 1995a,b; Welsch, 2002; Cummins, 1998; Helliwell, 2002). The results of these studies have been mixed, not showing any unambiguous relationships, due at least in part to problems with the data. A new international comparison study (Vemuri and Costanza, in review) has addressed some of these problems by combining data from the World Values Survey on SWB with data on proxies for the four basic types of capital: human, social, built, and natural. Regression models show that both the UN Human Development Index (HDI—which includes proxies for both built and human capital) and an index of the value of ecosystem services per km^2 (as a proxy for natural capital) are important factors in explaining life satisfaction (SWB) at the country level and together can explain 72% of the variation in life satisfaction. However, this study did not find a proxy for social capital that was a significant predictor in the regression models. This was due largely to the inadequacy of

available proxy variables for social capital at the national scale. In particular, there were no data at the national scale that reflected the most important components of social capital as they affect SWB. These components were identified by Easterlin (2003) to be interactions with family, friends, and neighbors.

In the current study, we assessed the SWB of residents in "intentional" communities. These are communities that were specifically designed to enhance their resident's quality of life by balancing concern for interpersonal relationships (social capital), personal growth and development (human capital) and connection with nature (natural capital) with needs for physical subsistence (built capital and income). Our hypothesis was that intentional communities could achieve a higher quality of life with less resource consumption than unintentional communities and could thus serve as models for sustainable development. To test this hypothesis, we surveyed residents of intentional communities and compared the results with a parallel survey of residents of Burlington, Vermont.

3.   Methods

In the fall of 2004, surveys were conducted by two classes at the University of Vermont as part of course-based research examining the link between quality of life within communities and the amount of four types of capital possessed by those communities—built, social, human, and natural. One course researched the design and success of ICs while the other was investigating the quality of life (QoL) within Burlington, VT. This research on QoL through primary data collection built on a Spring 2004 class that estimated the Genuine Progress Indicator (GPI) for Vermont, Chittenden County, and the City of Burlington through secondary data (Costanza et al., 2004).

Similar formats were purposefully used and several questions were nearly identical in each of the surveys. Both were modeled after other QoL surveys and sought to gauge the contribution of the four types of capital to individual QoL as well as residents' perceptions of the QoL within their community. In addition, many questions in the IC survey focused on aspects of life unique to ICs such as the presence or absence of a common vision, the communities' methods for allocating and rewarding work, and the balance of public (communal) and private space.

The survey of ICs was taken by a total of 84 residents from 30 different communities. Students made contact with a resident from each community and enlisted their aid in getting other residents to take the survey. The survey either was filled out in text form or was also available on the Internet. Respondents were largely self-selecting, and the percentage of respondents from each community was not uniform

The survey of residents of Burlington, VT was conducted simultaneously with 588 residents surveyed. Burlington was divided into eight distinct neighborhoods based on census characteristics of income, employment, education, and household characteristics. Neighborhood sample size was selected to be proportionate to the census population share,

and households were surveyed door-to-door using a systematic sampling rule. Survey demographics matched census characteristics within 10% in most categories.

A list of the parameters measured and the corresponding questions from the two surveys is given in the Appendix. The percentages of responses for each question are reported in Table 2 in the Results section. Five types of statistical analysis were conducted with the responses. Due to the ordinal and categorical nature of the data collected, Spearman's rank correlation test was used to identify statistically significant trends. The square of the correlation coefficient (represented by 's') measures the degree of variation in the rank of one parameter explained by variation in the rank of the other. For categorical data, the p-value measures the likelihood of a correlation (rejection of the null hypothesis) by indicating the probability that any observed pattern is likely to be the result of random interactions. Generally, we consider any result that have less than a 5% chance of occurring randomly to be significant, although occasionally this rule is violated for parameters from the IC survey that featured a high number of response categories relative to the number of respondents. In such cases, the results are indicative but not conclusive.

The coefficient s provides an indication of the strength of the observed trend by measuring the strength of the correlation between the ranks of two ordinal parameters. The sign of s indicates the direction of the trend. For our data, s is rarely above .3 which means $s^2 < 10\%$. However, for identifying factors that influence QoL, an issue of great complexity, a factor that is statistically shown to explain even a few percentage points of variation merits discussion. The high number of data points adds further weight to the analysis. Since the direction of ordinal categories is sometimes arbitrary, the correct interpretation of the sign of the coefficient will often depend on context.

Respondents were sorted into IC residents (community=1) and Burlington residents (community=2). When a parameter had a 'high' and a 'low' value, such as the importance to QoL of different types of capital, '1' was recorded as the highest level. Thus for a question like: "To what extent do the things you own contribute to your QoL?", a positive Spearman coefficient for the cross-community analysis implies higher responses on the part of IC members than on the part of Burlington residents.

For example, respondents were given five choices for the type of transportation they most frequently used—private car, car pool, public transit, bicycle, or walking. These were ranked from highest to lowest by their level of material throughput. The number of respondents in each category by community type is as shown in Table 1 with the percentage within each community printed beneath.

The Chi-square (χ^2) test for equal distributions yielded a p-value less than 0.0001 indicating a strong rejection of the null hypothesis that the distributions of modes of transportation for the two communities are identical. Spearman's correlation test also yielded a p-value less than 0.0001, leading us to reject the null hypothesis that an individual's rank regarding the sustainability of their mode of transportation is not correlated with whether they are from Burlington, VT or from an IC.

The s statistic was −0.33 indicating a fairly strong, negative trend in the table. To be precise, $s^2 = 0.11$ is equivalent to saying that 11% of the variation in rankings can be explained by

Table 1 – Sample data with Spearman's rank correlation coefficient					
	Private car	Car pool	Public transit	Bicycle	Walk
Intentional communities	20	4	3	8	39
	0.27	0.05	0.04	0.11	0.53
Burlington	422	10	18	29	93
	0.74	0.02	0.03	0.05	0.16

χ^2 p-value<0.0001.
Spearman's rank test p-value<0.0001.
Spearman's rank coefficient=−0.33.

community type. However, given the large number of ties due to there being only five categories, this measure is not necessarily quantitatively precise. Rather, it should be seen as an indication of the strength of the trend. For the example given, the trend appears quite strong with almost three times as many Burlingtonians relying on personal vehicles and three times as many IC residents walking.

4. Results

The analysis was performed in three sections. Each one is described below with the results tabulated and described immediately following.

4.1. Cross-community comparisons by question

Parameters were tested for equality of distributions between the two community types with the Spearman coefficient used to identify trends. The results are presented in Table 2. The p-value shown is for testing the null hypothesis that no significant trend exists. The percentage of respondents for each category by community is also shown.

Demographic characteristics of the two groups showed physical measures to be quite similar while many socio-cultural measures were statistically different. There was no statistical distinction between the two groups in gender, age, job tenure, or voter registration. Employment amongst those in the workforce was indistinguishable, but Burlington had a higher student population – 22% vs. 10% – despite the fact that several IC respondents were members of student cooperatives. The IC residents were a somewhat more diverse group with 16% of residents identifying themselves as non-Caucasian compared with 6% in Burlington.

Income distributions were quite different for the two groups. Amongst IC residents, no respondents were making more than $120,000 a year, and almost fifty percent were making less than $15,000. Burlington residents were on the higher end of the income scale with 59% of respondents making above $30,000 a year. The trend in income by community yielded a Spearman Rank Correlation Coefficient of −0.1741 and $p<0.0001$. Similarly, there was a significant difference in the distribution of those who lacked health insurance. 9% of Burlington residents were uninsured while 20% of IC residents lacked insurance, the χ^2 test yielding a p-value of 0.0036.

The level of education was statistically higher amongst IC residents ($s=−0.16$, $p<0.0001$) with almost twice as many IC

Table 2 – Spearman's coefficients for measured parameters by community				
Parameter		*p*-value		Spearman's coefficient
Gender		0.83		
Communities: 53% female, 47% male				
Burlington: 54% female, 46% male				
Age		0.26		
	<18	18–31	31–50	51–65	>65
Communities	0	0.29	0.43	0.23	0.06
Burlington	0.005	0.35	0.40	0.16	0.085
Ethnicity (1=white, 2=non-white)		0.006		−0.11
Communities: 84% White, 16% Non-White				
Burlington: 94% White, 6% Non-White				
Income		<0.0001		−0.17
	Over 120 K	60–120 K	30–60 K	15–30 K	Under 15 K
Communities	0	0.17	0.20	0.15	0.48
Burlington	0.08	0.22	0.29	0.19	0.23
Education (1=<HS, 2=HS, 3=Undergrad, 4=Grad)		<0.0001		−0.16
	<HS	HS	Undergrad	Grad
Communities	0	0.074	0.56	0.37
Burlington	0.018	0.20	0.58	0.20
Employment		0.76		
	FT	PT	UN	Ret	Stu
Communities	0.59	0.16	0.11	0.049	0.10
Burlington	0.49	0.10	0.09	0.09	0.22
Transportation (1=car, 2=ride share, 3=public, 4=bike, 5=walk)		<0.0001		−0.33
	Car	Ride share	Public transit	Bike	Walk
Communities	0.27	0.054	0.04	0.11	0.53
Burlington	0.74	0.018	0.032	0.051	0.16
Insurance (0=no, 1=yes)		0.004		0.11
ICs: 80% Insured, 20% Uninsured				
Burlington: 91% Insured, 9% Uninsured				
Vote		0.96		
Identical distributions				
Job tenure		0.93		
No statistically significant trend				
Health care		0.078		−0.07
	1	2	3	4	5
Communities	0.18	0.48	0.29	0.06	0
Burlington	0.33	0.38	0.18	0.07	0.04
Education opportunities		0.028		−0.09
	1	2	3	4	5
Communities	0.27	0.39	0.24	0.08	0.012
Burlington	0.36	0.42	0.16	0.05	0.011
Home		0.14		0.06
	Neighborhood	City	State	Greater region
Communities	0.41	0.46	0.025	0.11
Burlington	0.37	0.37	0.11	0.15
NB social		<0.0001		0.27
	1	2	3	4	5 (1=very important)
Communities	0.47	0.41	0.08	0.024	0.012
Burlington	0.17	0.35	0.34	0.11	0.036

Table 2 (continued)					
Parameter				p-value	Spearman's coefficient
FF social				0.003	−0.11
	1	2	3	4	5
Communities	0.66	0.27	0.06	0.018	0
Burlington	0.80	0.16	0.015	0.009	0.017
Public investments				0.62	
	1	2	3	4	5
Communities	0.20	0.29	0.43	0.06	0.01
Burlington	0.17	0.44	0.24	0.12	0.02
Personal investments				0.044	−0.08
	1	2	3	4	5
Communities	0.54	0.34	0.08	0.024	0.012
Burlington	0.65	0.28	0.047	0.007	0.017
Built				<0.0001	−0.21
	1	2	3	4	5
Communities	0.10	0.37	0.35	0.13	0.05
Burlington	0.30	0.46	0.15	0.06	0.03
Natural areas				0.37	
	1	2	3	4	5
Communities	0.59	0.25	0.12	0.04	0.00
Burlington	0.63	0.26	0.08	0.02	0.02
Individual QoL				0.005	0.11
	1	2	3	4	5 (1=highest, 5=lowest)
Communities	0.46	0.50	0.013	0.013	0.013
Burlington	0.35	0.47	0.10	0.06	0.016
Community QoL				0.02	0.09
	1	2	3	4	5 (1=highest, 5=lowest)
Communities	0.42	0.49	0.08	0.00	0.00
Burlington	0.41	0.44	0.13	0.01	0.00

residents (almost 40%) as Burlingtonians holding or pursuing a graduate degree. Given that Burlington is a college town, this suggests a much higher level of education than the national average.

Regarding the geographical region most identified as home, IC residents were statistically more likely to view an area close to where they live as home. When choosing among the following four regions – neighborhood, city, state, or greater region – 87% of IC residents selected their neighborhood or city as the region they most identified as home versus 74% amongst Burlington residents ($p=0.14$). Those who identified areas closer to where they live as home were more likely to rate the quality of their communities as high ($s=0.17$) and this trend was stronger amongst IC residents ($s=0.26$) than amongst Burlingtonians ($s=0.15$). Causation cannot be determined, but it is feasible that dissatisfaction with one's community leads to identifying with the larger geographic area more than the immediate community.

Differences in QoL were statistically significant, although the variation was not large. Overall, residents in both types of community were quite satisfied with their own lives and in their appraisal of QoL in their communities. Individual QoL was statistically higher amongst IC residents ($s=0.11$ and $p=0.005$) as was community QoL ($s=0.092$ and $p=0.02$), but this trend was not strong — which community one lives in only explained 1% of the variation in QoL.

4.2. Determinants of QoL, aggregate and by community

Spearman's rank test was used to test for correlation between various parameters and individual and community QoL. The analysis was done for all respondents and repeated for each community type separately to test for variations between the two groups. In particular, we were seeking to determine whether different factors affect individual and community QoL in an IC versus a more standard American community like Burlington. Results are given in Tables 3 and 4. Additionally, several questions only appeared in the IC survey. These were analyzed separately with the results being shown in Table 5.

Several factors could be identified that influence QoL for IC residents and Burlingtonians. Of further significance is that the strength of these factors was not uniform between the two groups. In particular, the quality of community relations was far more important for IC residents. Conversely, elements such as income and built capital were less influential. Indeed, the data suggests that IC residents substitute social capital for other forms of capital.

4.3. Social capital

There were statistical differences between the two groups regarding the importance of community interactions and the

Table 3 – Spearman's coefficients for individual QoL by parameter

Parameter	Aggregate	ICs	Burlington
Community	0.11	NA	NA
	0.0048		
Income	0.12	−0.12	0.17
	0.003	0.35	0.0002
Insurance	−0.074		−0.08
	0.06	0.33	0.05
Gender	0.08		0.09
	0.04	0.82	0.03
Home	0.09		0.10
	0.035	0.49	0.02
Neighborhood	0.15	0.25	0.12
	<0.0001	0.03	0.005
Friends and family	0.16		0.18
	<0.0001	0.18	<0.0001
Built	0.36	0.54	0.48
Public investment	0.23		0.26
	<0.0001	0.55	<0.0001
Personal investment	0.20		0.23
	<0.0001	0.71	<0.0001
Education opportunities	0.29	0.28	0.30
	<0.0001	0.01	<0.0001
Health care	0.26	0.27	0.27
	<0.0001	0.01	<0.0001
Natural areas	0.17	0.24	0.17
	<0.0001	0.035	<0.0001
Community_QoL	0.36	0.51	0.34
	<0.0001	<0.0001	<0.0001

Spearman's coefficients are given in top row of each entry with p-values displayed beneath.
Where Spearman's test was not significant, no coefficient is given.

importance of friends and family. IC residents were more likely to identify community interactions as important with 88% saying such interactions were 'Very Important' or 'Important' to their QoL versus only 52% of Burlingtonians ($s=0.27$, $p<0.0001$). Conversely, Burlingtonians were more likely to identify as 'Very Important' their interactions with family and friends though the trend was not as strong ($s=-0.11$, $p=0.003$).

For determining community QoL, community interactions were quite important, especially in ICs. For Burlington, the Spearman coefficient comparing the importance of community interaction to community QoL was 0.23. In ICs, it was 0.39, showing a much stronger trend amongst IC residents who place a high value on community interactions to also rate their community highly (s^2 over three times as high). Conversely, for Burlingtonians, the importance of friends and family was weakly correlated with a higher evaluation of community QoL ($s=0.09$, $p=0.03$). This trend was non-existent amongst IC residents.

Similar trends held for individual QoL. Burlingtonians who placed a high value on family and friends were more likely to identify themselves as having a high QoL ($s=0.18$, $p<0.0001$), while this trend was non-existent amongst IC residents. For both groups, the importance of community interactions correlated with individual QoL, but the trend was significantly stronger for IC residents ($s=0.25$ vs. $s=0.12$).

This suggests that many IC residents substitute one form of social capital, the intense community bonds and interactions that develop in an IC, for a more traditional form of social capital, our interactions with family and immediate friends. It also suggests that individuals who do not place as much importance upon community interactions are less likely to be happy in an IC. While this may appear obvious, it is a lesson many do not learn until they have joined an IC.

Several elements of social capital were also measured just for ICs to determine the degree to which they influenced QoL. A community's ownership provisions as well as its process for allocating work and rewarding contributions were both significant factors for individual QoL as well as for how IC residents rated QoL within their communities. The Spearman coefficients for how residents ranked ownership provisions were 0.22 for individual QoL and 0.17 for community QoL. The process for allocating work and rewarding contributions had coefficients of 0.33 and 0.21, respectively. The former suggests that a full 10% of a resident's happiness is determined by their satisfaction with how fairly a community divides up jobs and acknowledges effort, something confirmed by anecdotal evidence.

Interestingly, having a common vision was not an indicator of either individual QoL or community QoL. This idea is reflected in one of the tenets of co-housing in which residents are self-selecting. While many ICs do form around a common vision, the data does not indicate that this is important to providing residents with a high QoL. Also, being more welcoming of outsiders was not indicative of a higher QoL.

Table 4 – Spearman's coefficient for community QoL by parameter

Parameter	Aggregate	ICs	Burlington
Community type	0.092	NA	NA
	0.02		
Income	0.10		0.12
	0.02	0.85	0.007
Insurance			−0.08
	0.45	0.13	0.06
Home	0.17	0.26	0.15
	0.0001	0.02	0.0006
NB_Social	0.27	0.39	0.23
	0.0001	0.0003	0.0001
FF_Social	0.08		0.09
	0.04	0.42	0.03
Built	0.08	0.25	0.076
	0.05	0.03	0.076
Public investment	0.29	0.23	0.31
	0.0001	0.03	0.0001
Personal investment	0.16		0.20
	0.0001	0.72	0.0001
Education opportunities	0.22	0.15	0.24
	0.0001	0.16	0.0001
Health care	0.24	0.37	0.24
	0.0001	0.0005	0.0001
Natural areas	0.15	0.15	0.16
	<0.0001	0.19	0.0002
QoL		0.51	0.34
		0.0001	0.0001

Spearman's coefficients are given in top row of each entry with p-values displayed beneath.
Where Spearman's test was not significant, no coefficient is given.

Parameter	Individual QoL			QoL within the community		
	p-value	Spearman's rank coefficient	Spearman's rank *p*-value	*p*-value	Spearman's rank coefficient	Spearman's rank *p*-value
Ownership	0.005	0.22	0.05	0.08	0.17	0.12
Social interactions	0.001	0.23	0.04	0.002	0.37	0.0006
Preservation	0.64			0.02	0.37	0.0005
Welcome	0.72	0.18	0.11	0.63		
Common vision	0.06			0.18		
Allocation	0.21	0.33	0.003	0.17	0.21	0.061
Private space	0.76			0.45	0.18	0.10
Individual growth	0.10	0.37	0.0007	0.09	0.26	0.02

Table 5 – Individual and community QoL by parameter specific to ICs

Divergence between distribution *p*-value and Spearman's correlation *p*-value is due to the higher number of low-frequency responses which makes the χ^2 test for equal distribution unreliable.

4.4. Built capital

Built capital was investigated by examining the importance of purchased and rented goods, the importance of public investments, and the importance of income as indicated by being a factor in determining QoL.

For determining individual QoL, the importance attached to purchased and rented goods was not statistically significant for either group. For Burlingtonians, public investments and personal income were both significant ($s=0.26$ and 0.17, respectively). For IC residents, neither of these was significant, and in fact, the Spearman coefficient for income was negative ($s=-0.12$). Although the degree of variation indicates this is not statistically reliable, the displayed trend actually indicates a negative correlation between income and QoL.

For determining community QoL in Burlington, income and the importance of purchased and rented goods were both weak indicators of a higher QoL ($s=0.12$ and 0.08, respectively). However, public investments were quite significant ($s=0.31$). For IC residents, income was again not a statistical factor, but both public investment and purchased and rented goods were ($s=0.23$ and 0.25, respectively).

It is interesting that with regards to community QoL, IC residents attach less influence to public investments than do Burlingtonians, but they attach far more value to purchased and rented goods than they do in determining individual QoL. This suggests that amongst IC residents, built capital tends to be viewed as belonging more to the public realm rather than the private realm. This is affirmed by the fact that for IC residents personal income is not a determinant of either individual or community QoL. Indeed, the negative trend between income and individual QoL suggests that IC residents substitute other forms of capital–public built capital and social capital – for personal built capital.

4.5. Human capital

Three questions examined the importance of human capital: the importance of investments made in oneself (personal investments), the quality of educational opportunities, and the quality of health care. For all three of these, there was a trend (not strong) for IC residents to rate them lower than Burlingtonians. For Burlingtonians, all three were strong indicators of both individual and community QoL. For IC residents, the quality of health care was a determinant of both measures of QoL, while educational opportunities were only an indicator of individual QoL and personal investments were not an indicator of either. This suggests another degree of substitution with social capital replacing human capital amongst IC residents.

Further, it is through human capital that IC residents are able to make another substitution of social capital for income. Health care, and to a lesser degree educational opportunities, are strong indicators of quality of life. Indeed, these are two factors that many consider when considering where to live and they are key drivers of property values. This is supported by the fact that assessments of health care and education were both correlated with income in Burlington ($s=0.14$ and 0.15, respectively, with $p<0.001$ for both). However, neither of these is correlated with income for ICs. IC residents have managed to make these two indicators of individual QoL available to residents in a manner that ignores income.

4.6. Natural capital

We were able to find only one question on each survey that was comparable in terms of measuring the importance of natural capital. This question, assessing the importance of interactions with natural spaces to QoL, revealed only minor differences between the community types. Both types had a fairly strong correlation between the importance of natural areas and both individual and community QoL ($s=0.17$ and 0.15, respectively, with $p<0.0001$). However, with regard to individual QoL, the trend was significantly stronger for ICs ($s=0.24$). We see a parallel to social capital in that, while natural capital is important to both groups, it plays a more instrumental role in the well-being of IC residents.

For ICs alone, a second question asked what emphasis the community placed upon the preservation of natural areas. While the responses were not correlated with individual QoL ($p=0.64$), they were strongly correlated with community QoL ($s=0.37$ with $p=0.0005$). This is one of the strongest correlations seen in our study suggesting not only the importance of natural capital but also the linkage between community involvement in conservation and community well-being within ICs.

4.7. Capital contributions to QoL by community

Finally, composite indicators for social, human, built and natural capital were calculated and Spearman's rank test was used to determine their correlation with individual QoL and community QoL. The indices were calculated by multiplying the responses to all questions that were pertinent to that capital category. For natural capital, there were no questions in the Burlington survey that corresponded to the IC survey. However, four other questions regarding the value of natural capital were used. Since there were several questions in the IC survey that did not have a parallel in the Burlington survey, the indices varied somewhat between the two community types and should not be used for an exact comparison. Rather, they should be taken as broader indicators of the contribution of each type of capital to QoL. The results are presented in Table 6.

These four capital product indices give us a way of ranking the factor proportions of the four capitals in terms of determining individual and community QoL. Amongst IC residents, the social capital index was the most significant component of individual and community QoL, explaining 3 to 4 times as much of the variation of individual QoL as the other capitals. Human capital and natural capital were also determinants, though more influential for community QoL than individual QoL. Built capital was the weakest determinant, showing no significance for individual QoL.

Amongst Burlingtonians, human capital was the strongest indicator, with social capital, natural capital and built capital having roughly equal influence. It is conceivable that the influence of human capital results from Burlington being a university town. Also of significance was the difference in correlation between individual QoL and community QoL. In ICs, variation in community QoL accounted for a full 26% of individual QoL while it was only 11% for Burlingtonians. Clearly, the value derived from increased social capital comes at a cost of greater interdependence.

4.8. The question of sustainability

Not enough data has been gathered to make a sound judgment that ICs are more sustainable than a city like Burlington. Indeed, given Burlington's reputation as one of the most sustainable cities in the world (Bamburg, 2002), a great burden of proof lies upon the challenger. However, some elements of our survey certainly suggest that ICs enable their residents to pursue a more sustainable lifestyle. By substituting social capital for built capital, ICs provide a higher quality of life to their residents despite significantly lower income. By converting private goods into public goods, it is feasible that ICs enable all to live better with less capital.

Survey results also showed a greater reliance of IC residents upon their communities, not only for social support, but also for economic support, with many residents reporting they worked at home or nearby. Indeed, when modes of transportation were ranked according to their sustainability, statistical analysis showed IC residents far more likely to use a more sustainable mode of transportation ($s=-0.33$, $p<0.0001$). Further, amongst Burlingtonians, there was a weak trend correlating a less sustainable mode of transportation with a higher reported QoL ($s=0.07$), reinforcing, if weakly, a common stereotype that it is the less fortunate who must walk or take the bus. However, for IC residents, there was a strong trend correlating a more sustainable mode of transportation with a higher quality of life ($s=-0.31$).

5. Concluding remarks

Results of this study represent an existence proof: it is possible to achieve a high (and probably more sustainable) quality of life while consuming at rates much less than the U.S. average. To do this, one needs to be aware of the need for balanced contributions from built, human, social and natural capital and to design our communities accordingly. Among unintentional communities, Burlington is often ranked among the highest in terms of quality of life (Costanza et al., 2004), and yet intentional communities ranked even higher while consuming much less.

We have much to learn from intentional communities around the world that have been actively experimenting with issues related to quality of life and sustainability, and from comparisons of these communities with unintentional

Table 6 – Correlation of individual and community QoL with capital indices					
Community type	Parameter	Individual QoL		Community QoL	
		p-value	Spearman's coefficient	p-value	Spearman's coefficient
Intentional communities	Social capital index	0.0001	0.42	0.0003	0.40
	Human capital index	0.06	0.22	0.006	0.30
	Built capital index	0.47		0.03	0.25
	Natural capital index	0.02	0.26	0.002	0.33
	Individual QoL			<0.0001	0.51
	Community QoL	<0.0001	0.51		
Burlington	Social capital index	<0.0001	0.16	<0.0001	0.23
	Human capital index	<0.0001	0.33	<0.0001	0.27
	Built capital index	<0.0001	0.21	<0.0001	0.28
	Natural capital index	<0.0001	0.18	<0.0001	0.13
	Individual QoL			<0.0001	0.34
	Community QoL	<0.0001	0.34		

communities at various scales. The current study has only scratched the surface of what will likely turn out to be a very fruitful research area.

Acknowledgements

Appendix A
Parameters and corresponding questions

Parameter name	Ecovillage survey	Burlington survey
Age	What is your age?	Age
Gender	What is your gender?	Gender
Ethnicity	Please describe your ethnicity.	How would you best characterize your race and ethnicity? [ ] White/Caucasian [ ] Black/African [ ] Hispanic or Latino [ ] Asian/Pacific Islander [ ] Other
Employment	Please describe your employment status.	What is your current employment status? [ ] Employed, and 　[ ] over-time (>40 h/week) 　or [ ] full-time (30–40 h/week) 　or [ ] part-time (<30 h/week) [ ] In school, and [ ] working 　or [ ] looking for work 　or [ ] not looking for work [ ] Unemployed, and [ ] retired 　or [ ] looking for work 　or [ ] not looking for work
Job tenure	How long have you worked at your current Job (years)?	How many years have you been working at your current place of employment?
Transportation	What is your most-used method for getting to and from work?	What is the main way you get around (to work, the store, school, etc.)? [ ] Walk [ ] Bike [ ] Public transportation [ ] Ride share [ ] Personal or family car [ ] Other
Income	Please state your yearly income (dollars).	What is your yearly [ ] *family*, or [ ] *personal* income? Please check which applies. [ ] Under $15,000 [ ] $15,000–$30,000 [ ] $30,000–$60,000 [ ] $60,000–$120,000 [ ] Over $120,000
Members in household	How many people live in your household?	Number of people who live in your household.
Education	What is your highest level of formal education?	What level of education have you completed to date? [ ] No high school diploma

(continued on next page)

Appendix A (*continued*)

Parameter name	Ecovillage survey	Burlington survey
Education		[ ] High school diploma [ ] Associates degree [ ] Bachelors degree [ ] Graduate degree
Insurance	Do you have health insurance?	Do you have health insurance?
Vote	Are you a registered voter?	Are you registered to vote? [ ] Yes [ ] No [ ] Not a US citizen
Home	Of the following regions which do you most identify as your home? 1. Neighborhood 2. Town or City 3. Greater Region	Please rank the *top five* regions according to which ones you *most* identify with as your home, from 1 (most identify) to 5 (least identify). [ ] My neighborhood in Burlington [ ] City of Burlington [ ] Chittenden County [ ] State of Vermont [ ] New England [ ] Northeastern United States [ ] United States [ ] North America [ ] The World [ ] Other: _____
Built	To what extent do the things that you own or rent (e.g. home car furniture clothes sporting equipment, etc.) contribute to your quality of life?	How *important* are the things you own or rent (for example, your home, car, furniture, clothes, etc.) to your happiness and quality of life?
Public investments	To what extent do the public structures in your community (streets sidewalks street lights parking, etc.) contribute to your quality of life?	How *happy* are you with the public investments in your neighborhood (for example, streets, sidewalks, streetlights, parking, public septic, etc.)?
Private investment	To what extent do the private investments (e.g. shops restaurants offices, etc.) in your community contribute to your quality of life?	How *happy* are you with the private investments in your neighborhood (for example, shops, restaurants, offices, etc.)?
Bought	To what extent do personal income and the goods and services you purchase contribute to your quality of life?	From the following items, please first rate them according to how *important* they are to you. *Rating of importance:* [ ] Home (either owned or rented) [ ] Automobile or other (_____) mode of transportation [ ] Food and drink [ ] Furniture, appliances, and other household goods [ ] Clothing, shoes, jewelry, and other personal accessories [ ] Entertainment goods (skis, bike, video games, etc.) [ ] Other: **Geometric average taken.**
Personal investments	To what extent do investments made in yourself for personal growth (e.g. education job skills health spirituality, etc.) contribute to your quality of life?	How *important* are investments made in yourself (for example, education, job skills, health, spirituality) to your happiness and quality of life?
Health care	The support for human health in the community is:	Please rate how *happy* you are with their current amount and quality. [ ] Health care
Education opportunities	The educational opportunities in the community are:	Rate how *happy* you are with their current amount and quality. [ ] Formal or informal education
FF social	To what extent do relationships with your family and friends contribute to your quality of life?	How *important* are relationships with your family and friends to your happiness and quality of life?
NB social	To what extent do interactions with people in your neighborhood or community contribute to your quality of life?	How *important* are interactions with people in your neighborhood to your happiness and quality of life?
Individual QoL	How would you describe your own overall quality of life?	How would you rate your overall quality of life?
Natural areas	To what extent does interaction with natural areas (open space forests, etc.) in or near your community contribute to your quality of life?	How *important* is the quality of the natural environment in which you live (for example, air, water, open space, cleanliness) to your happiness and quality of life?
Community QoL	What is the overall quality of life in your community?	Please rate how *happy* you are with the current overall quality of these regions (considering the general health of their economy, society, and environment). [ ] My neighborhood in Burlington [ ] City of Burlington

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