LANDSCAPE PERFORMANCE SERIES

EcoVillage at Ithaca

Methodology for Landscape Performance Benefits
Cornell University
Case Study Investigation 2014

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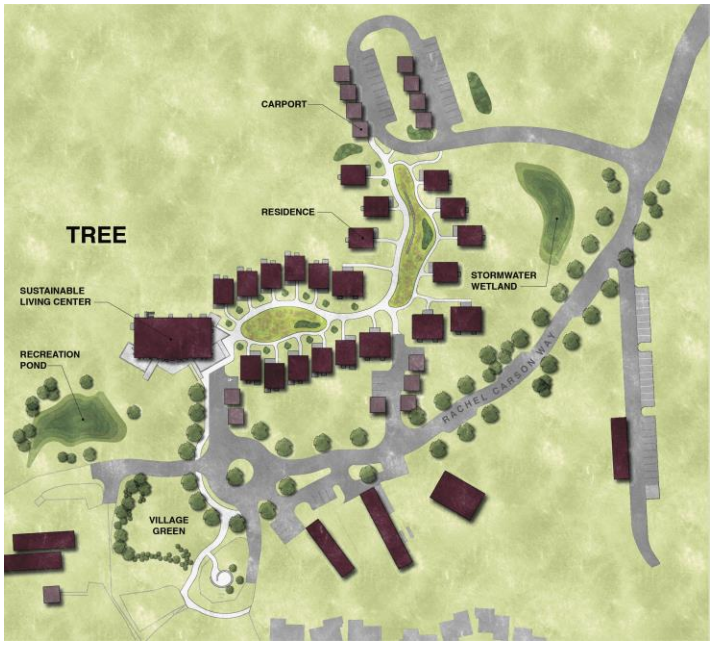
EcoVillage Site Plan, Mujahid Powell



TREE Site Plan. Liz Kushner and Michele Palmer

Introduction:

Robert Gilman in his book "The Eco-Village Challenge" defined the EcoVillage concept as "human-scale full-featured settlement in which human activities are harmlessly integrated into the natural world in a way that is supportive of healthy human development, and can be successfully continued into the indefinite future."

EcoVillage at Ithaca (EVI) is a 175 acre planned cohousing community with 100 residences located in three, five-acre neighborhoods and a village association that holds roads and parking areas separate from the agricultural lands and natural areas. The three neighborhoods are called:

- First Residents Group (FROG)
- Second Neighborhood Group (SONG)
- Third Residential EcoVillage Experience (TREE)

Residences are privately owned and contain the amenities of conventional homes such as kitchens and baths, but residents also have access to extensive common facilities such as open space, community gardens, play areas and a community center called a common house with a neighborhood laundry. The newest neighborhood, TREE, includes 40 residences and a common house, supporting the EVI community's goals of sustainability, accessibility, and affordability. The site design plays a key role in creating a pedestrian-oriented social neighborhood while its cluster design allows more than 80% of the 175 acre site to be set aside for natural areas, wildlife habitat, and organic farming. Through its consensus based decision-making process, creative site design and building methods, the community fosters sustainable lifestyle choices, impacting collective resource use and waste production.

EcoVillage at Ithaca is a planned cohousing community that, since its inception in 1991, has been recognized nationally and internationally for its pioneering work in developing a mainstream, green community that appeals to middle-class Americans while cutting resource use by more than half. It is the largest and one of the most well-known EcoVillages in the U.S.

While EVI has always set and met strong goals for sustainability, with TREE, those goals go significantly further. TREE is the largest cluster of residences built to Passiv Haus standards in the United States. Early testing as part of a grant from the U.S. Environmental Protection Agency shows that these homes use approximately 90% less energy than a typical home while earlier EVI homes use approximately 40% less.

Research to date has focused on the buildings and energy efficiency in particular. Because of the siting requirements for solar gain and the overall philosophy of EVI, it is impossible to separate the architecture from the site design as a residential neighborhood to grasp the whole picture. EVI, in partnership with Tompkins County, has been the recipient of an EPA Climate Showcase Grant that is currently being implemented. This grant is being used to study building performance and monitor energy usage, water consumption, vehicle usage and quality of life issues. The end product of the study is expected to be the development of mainstream standards for new development and a sharing of lessons learned over the past twenty years. The study has interesting synergies with the LAF's Landscape Performance Series. Largely focused on the buildings, this study provides a background for studying the landscape and site, which are highly integrated at EVI. The sharing of this information is expected to attract attention at a national level and could be augmented with the landscape performance study to garner attention to the benefits of an integrated landscape approach.

Below is a summary of the key sustainable lifestyle features of the EcoVillage at Ithaca community developed and written by Liz Walker, author, founder and resident.

1. GREEN BUILDING, ENERGY EFFICIENCY, AND RENEWABLE ENERGY: All homes are passive solar, super-insulated, and many have photovoltaic panels and solar hot water heating. Newest homes will demonstrate Passiv Haus standards,

FROG Commonhouse and Pond, Mujahid Powell

which typically reduce energy use by 90% compared to typical homes. In January, 2012, the first neighborhood installed a 50 KW ground-mounted photovoltaic system, which provides approximately 50% of the electricity for 30 homes.

2. DENSELY CLUSTERED HOUSING: EVI is a pedestrian village of three neighborhoods-100 homes on a footprint of less than 15 acres. More than 80% of the 175 acre site is set aside for natural areas, farming, and wildlife habitat.

3. LOW RESOURCE USE: In three separate studies (MIT, Cornell, and Ithaca College), EcoVillage residents demonstrate 40% reduction in home energy use, compared to typical homes in the northeast. More recent studies show a 40% reduction in natural gas, a 53% reduction in electricity, and a 71% reduction in water use.

4. STRONG SOCIALTIES: Each of the three EVI neighborhoods are NYS housing cooperatives, based on "Cohousing", with shared common facilities, and many shared social events, including several community meals a week. Residents love living at EVI.

5. LOCAL FOOD PRODUCTION Two resident-owned farms supply organic fruits and vegetables to 1,000 county residents through CSA shares and U-pick berry harvesting during the growing season.

6. ON-SITE BUSINESSES: Almost half (45%) of wage-earning residents work or telecommute from home offices, or provide services for neighbors, lessening the need for commuting.

7. EXTENSIVE COMPOSTING, RECYCLING AND RE-USE: Residents compost all non-meat kitchen scraps, and have cut need for garbage services by 75%.

8. AFFORDABLE, ACCESSIBLE: TREE, the newest neighborhood, was planned to build as affordably as possible, while also planning for aging in place.

9. OPEN SPACE PRESERVATION: EVI preserves 80% land for agriculture, natural meadows, forests and ponds.

10. HANDS-ON EDUCATION: EVI-CSE works closely with Ithaca College and provides at least one accredited course per semester on the topic of community sustainability. The partnership has increasingly spent time in cultivating partnerships with downtown communities, and provides cultural competency trainings to I.C. professors and students. EVI-CSE provides tours for about 1,000 visitors a year, and currently has two robust educational programs – Groundswell Center for Local Food & Farming, and EPA Climate Showcase Communities.

Research Strategy and Methods Used:

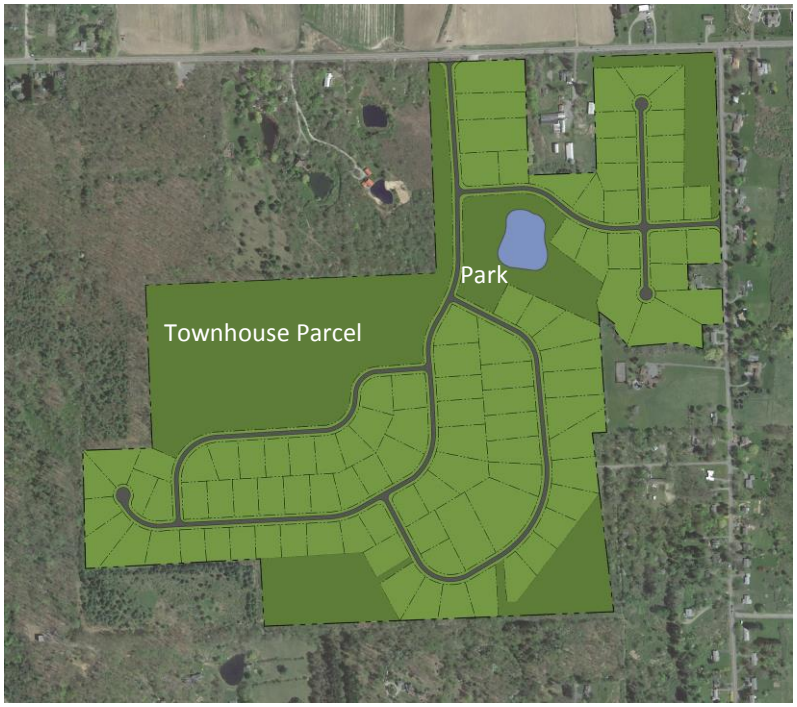
While many contemporary design projects focus on mitigating the impacts of development using green infrastructure, the EcoVillage community has focused on preventing development impacts from the planning stages of the project. This spirit of avoidance is most evident when looking at a development plan prepared for the same property for a local development company which was considering the property and followed suburban subdivision convention in the concept plan. Two scales of research have been engaged in this case study: 1. The TREE neighborhood and 2. The overall EcoVillage community. Each comparison made in this case study will state the scale on which it is being focused.

As is mandated by the format of the case study program, the performance benefits studied fall under three broad categories: Environmental, Social, and Economic. The primary source of information about the project was the design team and the construction documents for the project. Residents of EcoVillage generously contributed to our understanding of the project and consented to interviews, site tours and ongoing conversations. Exit surveys were also conducted with visitors who participated in the monthly tours given at EVI for the general public. Detailed information about the performance benefits assessed follow as performance indicators.

Plat Plan Comparison Methodology:

In order to fully appreciate the impacts of the different design strategies used by the EcoVillage community as compared to the Lakeside Development Inc. proposal, this case study compares both site plans using the developer's design as a 'control' representing conventional practice. Because EcoVillage has been constructed, all measurements have been collected using area takeoffs from construction documentation, site surveys, aerial photographs, and on-site observation. The Lakeside Development plan however, was only produced to a conceptual level. In response, this case study uses local standards and legal restrictions to 'fill in the gaps'.

The Lakeside plat plan shows 100 single family residences and 50 townhouse units, including proposed parcel boundaries and road alignments. Because the townhouse units were not permissible under local zoning at the time, this case study assumes that the townhouses would not have been constructed. For the purpose of strict area comparisons, the land currently dedicated to townhouse construction is considered vacant, however this assumption will not be held constant for more generalized comparisons of disturbance as this land would realistically have been subdivided into typical lots similar to the remainder of the plan. Because the Lakeside plat plan does not include the same level of detail as construction documents for EcoVillage, measurements for missing elements are developed using local standards for road construction and building footprint, as well as site layout restrictions under the zoning R-30 which requires the following:



Plat Plan, Mujahid Powell after Plan developed by Hunt Engineers and Architects, Corning, NY

Zoning Requirements:

Minimum lot size: 30,000 s.f., not more than 10% lot coverage.

1. 100’ min. at street (frontage)
2. 150’ minimum lot width (60 feet from street)
3. 200’ min. depth

Setbacks:

1. Front 30’ min.
2. Side 40’ min.
3. Rear 50’ min.

Measurements and Assumptions:

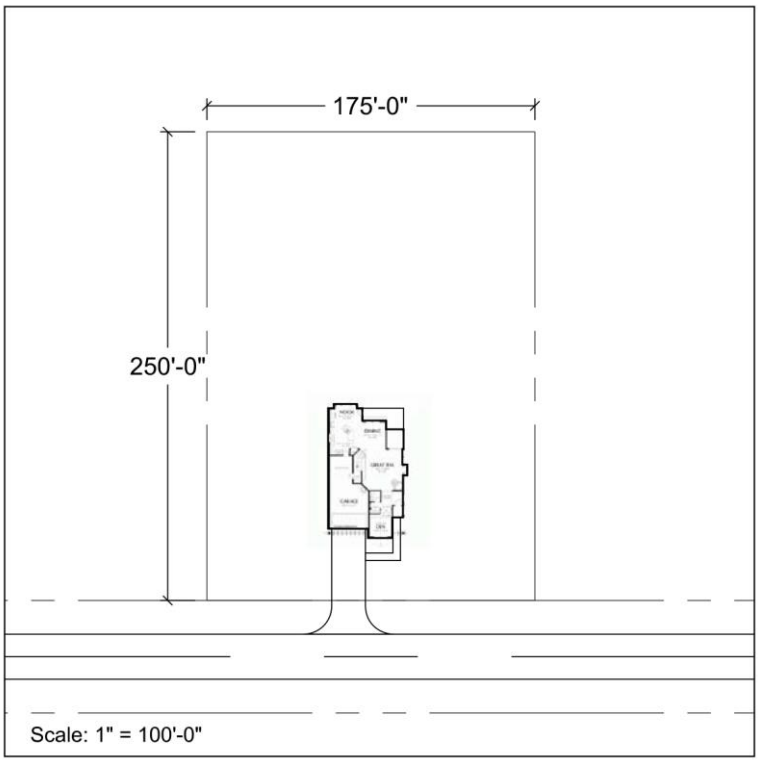
The plat plan for Lakeside Development’s proposal lacks the detail of a construction document including building footprints, actual roadway layout (only includes Rights of Ways), sidewalks, and driveways. These are estimated using zoning requirements minimum set-backs and local averages for the road width of 24’. A sample house plan was selected from Dream Home Source online architectural plans to develop the example lot to establish lot coverage.

The portion of the plat plan showing single family homes conformed to the above zoning requirement with an average lot size of just over one acre. The land use breakdown for the plat plan is as follows:

Total Acreage:	175 acres
R-30 Residential:	100.49 acres
Multi-Family:	30.93 acres
Open space:	16.78 acres
Park (turf)	7.80 acres
Pond within Park (Open Water):	1.86 acres
Roadway R.O.W.:	17.16 acres (total area)
Road Paved:	7.09 acres (paved portion of R.O.W.)

Typical Lot

A Typical Lot Plan was developed conforming to the above zoning with an approximately one acre lot size.



Typical Single Family Lot Plan, Michele Palmer

The assumed coverages also conform to the Center for Watershed Protections assumptions for the Water Treatment Model spreadsheet: 10% Impervious, 20% Landscaped and 70% Turf. The plan breakdown for lot coverage is as follows:

Land Use	Square Feet of Coverage	Percent Coverage
Building Footprint	2,400	5.5%
Driveway	1,100	2.5%
Hardscape	875	2%
Landscaped	8,750	20%
Turf	30,625	70%
Total Lot	43,750	100%

Plat Plan Comparison Limitations: Area values at EcoVillage are collected with area takeoffs from construction documents and aerial photographs, introducing human error. Similarly, values for the Lakeside plat plan are not exact. Instead they are based on the assumptions described above.

Performance Indicators:

Environmental

Performance Indicator 1:

- *Retains 100% of storm water runoff from developed areas of the site for up to a 100-year storm with no impacts on or connections to the municipal storm-sewer system.*

The EcoVillage Property is in a suburban to rural area with no connections available to the municipal storm system. The site runoff is infiltrated through sheet flow through meadows or captured in a manmade stormwater wetland. Below Table 4 from the SWPPP for TREE shows small decreases in peak flow rates.

TABLE 4. CONTROLLED PEAK FLOW RATES (CFS)

		1-year	10-year	100-year
Watershed 'B' Upper	Peak Discharge at Watershed Outlet (cfs) (increase over pre-developed in parentheses)	22.41	86.68	165.86
Watershed 'B' Upper 2	Peak Discharge at Pond Inflow (cfs)	2.45	7.11	12.38
	Pond Storage Volume (acre-ft)	0.24	0.41	0.57
	Peak Discharge at Pond Outflow (cfs)	0.13	2.67	6.00
Point of Analysis (at inflow to existing dry basin)	Peak Discharge (cfs)	22.41 (-1.38)	86.80 (-5.22)	171.33 (-4.75)

For the older two neighborhoods of EVI, Stormwater runoff generated by the FROG neighborhood and SONG neighborhood is collected in a 1 acre pond and a dry basin capable of detaining 1.8 acre-feet of runoff. Water quality treatment occurs through filtration, sedimentation, biological removal and particle retention across the natural vegetation of lawn and meadow. The Environmental Impact Statement provided for the project did not predict any adverse impacts on water quality or peak flow rates.

Methods: Review of project Stormwater Pollution Prevention Plan (SWPPP) and Generic Environmental Impact Statement (GEIS) provided by T.G. Miller P.C.

Limitations: Some of the gravel roadway that existed prior to TREE was exempt from study in TREE's SWPPP. The roadway is bordered by meadow and has ample opportunity to infiltrate through sheet flows but some runoff may still occur in large storm events.

Environmental

Performance Indicator 2-3:

- *Generates an estimated 61% less runoff than the conventional residential subdivision proposed from the site. Predicted runoff for EcoVillage is 42.1 acre-feet per year compared to 108.3 acre-feet for the conventional subdivision.*
- *Reduces annual nitrogen loads by an estimated 14%, phosphorous by 32%, and suspended solids by 10%, compared to the conventional residential subdivision proposed for the site.*

Methods: Values for nutrient and sediment removal as well as runoff reduction are calculated using the Watershed Treatment Model (WTM) produced by the Center for Watershed Protection. Refer to plat plan comparison methodology for more information on area take-offs.

INPUTS:

Land Use	Undeveloped (acres)	Lakeside (acres)	EcoVillage (acres)
Lakeside Residential	--	100.481	--
Park	--	7.797	--
EVI Residential *	--	--	34.170
Roadway	--	17.160	--
Forest	22.726	19.110	22.070
Rural (ag. & meadow)	151.894	28.595	118.38
Open Water	0.380	1.857	0.380
Total	**175**	**175**	**175**

CONSTANTS:

Land Use	Impervious Cover (%)	Turf Cover (%)	Nitrogen (mg/liter)	Phosphorous (mg/liter)	Suspended Solids (mg/liter)
Lakeside Residential	10%	70%	2.1	0.31	49
Park	5%	76%	2.1	0.31	49
EVI Residential *	23%	11%	2.1	0.31	49
Roadway	45%	44%	2.3	0.25	134

Land Use	Total Nitrogen (lb/acre/year)	Total Phosphorous (lb/acre/year)	Total Suspended Solids (lb/acre/year)
Forest	2.5	0.2	100
Rural (ag. & meadow)	4.6	0.7	100
Open Water	12.8	0.5	155

OUTPUTS:

	Calculated Values			% Change		
				Undeveloped		Lakeside vs.
	Undeveloped	Lakeside	EcoVillage	vs. Lakeside	vs. EcoVillage	EcoVillage
Nitrogen (lb/year)	760.4	835.9	722.2	10%	-5%	**-14%**
Phosphorous (lb/year)	111.1	152.1	103.5	37%	-7%	**-32%**
Suspended Solids (lb/year)	22779.1	23719.8	21279.6	4%	-7%	**-10%**
Runoff (acre-feet/year)	20.4	108.3	42.1	431%	106%	**-61%**

Limitations: The Watershed Treatment Model (WTM) is a spreadsheet-based tool designed to estimate the benefits of a wide range of management practices in urban and suburban watersheds. The tool is typically applied to large scale studies of entire watersheds and larger developments, making this spreadsheet the appropriate tool to study a project of this scale. While stormwater practice remove many other pollutants such as metals, the spreadsheet was developed to study those currently regulated and so only nitrogen, phosphorous and suspended solids are studied. Refer to Introduction for limitations associated with area takeoffs.

Performance Indicator 4:

- *Reduces irrigation needs for turf by 95% compared to the conventional residential subdivision planned for the site. EcoVillage contains only 3.62 acres of turf.*

Methods: Turf irrigation was compared between EcoVillage and the conventional residential subdivision planned for the same property using estimates of turf coverage per unit entered into the EPA WaterSense Water Budget spreadsheet tool. Turf coverage at EcoVillage was estimated using aerial photography with on-site observations for verification. Then, because there are no individual lots at EcoVillage, this overall estimate of 3.62 acres of turf was divided by 100 units to provide an input of 1577 square feet per home in the EPA WaterSense spreadsheet. Turf coverage for the conventional subdivision planned by Lakeside Development Inc. was determined at a parcel scale using the development's average lot size of one acre and the average of 70% turf coverage on a residential lot used by the Center for Watershed Protection. At 70% turf coverage, there is an average of 30,492 square feet of turf per home. Constants and results for the EPA WaterSense Calculator are provided below:

- Local Peak Watering Month: *July*
- Local Reference Evapotranspiration (in/month): *5.62"*
- Average Monthly Rainfall for peak watering month: *3.26"*
- Low Water Requirement Turfgrass Landscape Coefficient (K_L): *0.6*

	Conventional Subdivision	EcoVillage	% Difference
Peak Month Water Requirement	74,769 gallons	3867 gallons	94.8%

Limitations: Observations of local turf irrigation habits in Ithaca appear to be much lower than estimates of water use provided by the EPA, therefore, it is believed that the relative values provide an accurate comparison whereas the actual values may be inaccurate. On average, Ithacans are more ecologically sensitive in their lawn care habits than what might otherwise be seen in other parts of the country. Irrigation systems are rarely installed in Ithaca and it is observed that the majority of homeowners allow their lawns to go dormant in periods of drought. Refer to Introduction for limitations associated with area takeoffs.

Performance Indicator 5:

- *Avoided the release of approximately 1,330 tons of CO2 by preserving 20 acres of woodlands. These trees also sequester 43 tons of CO2 annually.*

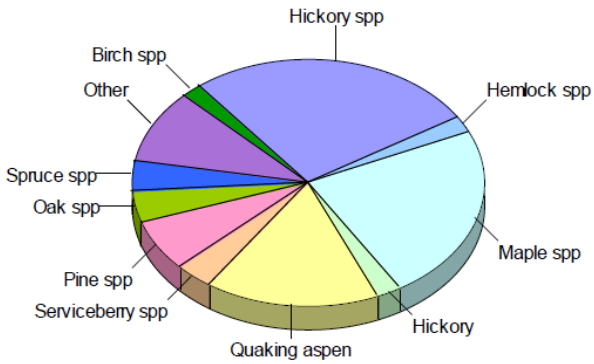
Methods: Estimates of tree benefits are produced based on random tree data collection and analysis conducted using iTree Eco software and methodology. Equivalents were generated by the software and delivered in an appendix at the end of the report. A random sample of the existing forest was developed using the ArcGIS geoprocessing tool that creates a specified number of random points within a user defined area. These points were selected as the centers of our sampling plots which were circular and 37.2' in radius (0.1 acres). The coordinates of these random points were entered into a portable Garmin GPS unit and were located on the site using the waypoint "find" feature. Four teams of two persons each were instructed in the use of the data collection worksheets and estimation strategies for canopy height, size and coverage.

Collecting Tree Sample Plot Counts, Gregory Kelly

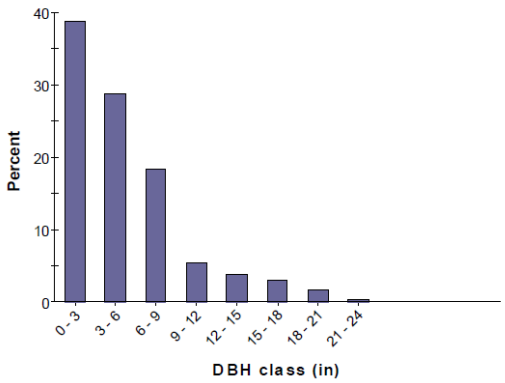
An inventory of trees and other information required by the iTree software were recorded for each random plot using a custom data collection form created by the survey team. Trees were recorded as recommended in the iTree instruction manual (DBH above 1" and greater than 12' in height) and other information such as DBH, canopy characteristics and vegetative cover was also collected.

The inventory of each plot began at 0 degrees (due north) and proceeded clockwise around the area, recording distance from center and degrees of rotation for each successive individual inventoried. Trees were measured, identified as to their genus and characteristics of their canopy shape and density were recorded along with the extent of canopy light exposure and percentages of shrub and ground coverage.

This data was then used to estimate the carbon sequestration of woodlands on the site using iTree Eco. Summaries of iTree Eco outputs are found below:



Tree Species Composition



Distribution of Tree Population by Diameter Class

Summary from i-Tree Eco:

Understanding an urban forest's structure, function and value can promote management decisions that will improve human health and environmental quality. An assessment of the vegetation structure, function, and value of the EcoVillage urban forest was conducted during 2014. Data from 5 field plots located throughout EcoVillage were analyzed using the i-Tree Eco model developed by the U.S. Forest Service, Northern Research Station.

- Number of trees: 14,700
- Tree cover: 100.0%
- Most common species: Hickory spp, Maple spp, Quaking aspen
- Percentage of trees less than 6" (15.2 cm) diameter: 67.5%
- Pollution removal: 1 tons/year ($15.7 thousand/year)
- Carbon storage: 1,330 tons ($94.8 thousand)
- Carbon sequestration: 43 tons/year ($3.04 thousand/year)
- Oxygen production: 105 tons/year ($0 /year)
- Avoided runoff: 51,400 cubic feet/year ($3.42 thousand/year)
- Building energy savings: $0/year
- Avoided carbon emissions: $0/year
- Structural values: $2.55 million

Ton: short ton (U.S.) (2,000 lbs) Carbon storage: the amount of carbon bound up in the above-ground and below-ground parts of woody vegetation. Carbon sequestration: the removal of carbon dioxide from the air by plants. Carbon storage and carbon sequestration values are calculated based on $71 per ton Structural value: value based on the physical resource itself (e.g., the cost of having to replace a tree with a similar tree)Pollution removal value is calculated based on the prices of $1136 per ton (carbon

monoxide), $5981 per ton(ozone),$630 per ton (nitrogen dioxide), $171 per ton (sulfur dioxide), $25866 per ton (particulate matter less than 10microns and greater than 2.5 microns), $182564 per ton (particulate matter less than 2.5 microns)Energy saving value is calculated based on the prices of $199.8 per MWH and $15.27 per MBTU Monetary values ($) are reported in US Dollars throughout the report except where noted.

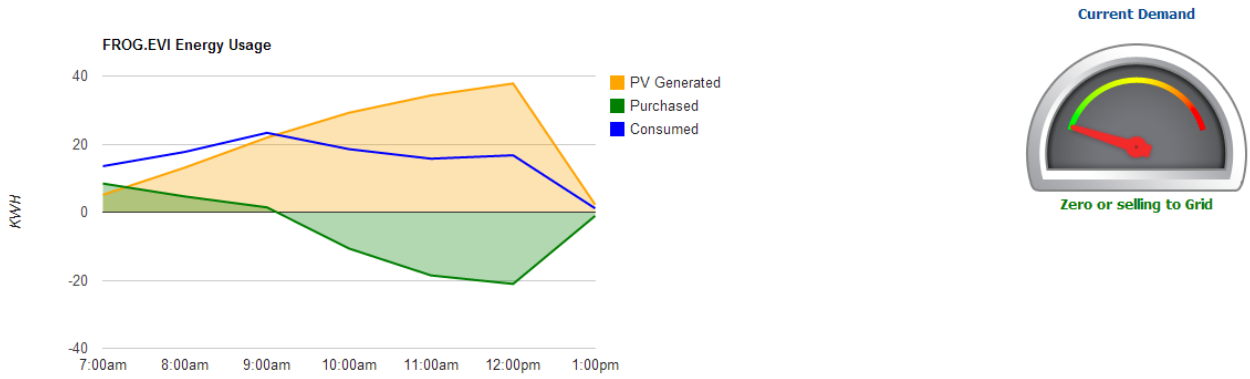
Limitations: iTree estimates a 50% margin of error when using 10 sample plots, however iTree is typically used by municipal organizations and urban forest managers which likely work with much larger project areas than the 20 acres of forest sampled at EcoVillage. Walking the site a consistency of canopy, distribution of trees, and groundcover was observed which should make the findings more accurate than iTree's estimates might suggest. We have no way to quantify this error independently. In the preliminary assessment of the forest, only one tree species was observed that did not appear in any of the sample plots. It is understood that the carbon stored in the trees would not be immediately released unless the wood was burned. Release would likely take place over time and in several forms.

Performance Indicator 6:

- *Produces about 60,000 kWh per year with ground-mounted photovoltaic arrays. This supplies 42% of the FROG neighborhood's energy, avoiding 250 tons of CO2 emissions annually.*

Methods: EcoVillage systematically tracks the community's energy usage and power generation through solar photovoltaics which are both ground mounted and building mounted. This tracking occurs at the community level, neighborhood level, home level and array level. Below is a snapshot of the electrical usage for the FROG Neighborhood on August 1, 2014.

FROG.EVI



Totals

	Used			Generated				Purchased			
	KWH	Cost	CO^2	KWH	Cost	CO^2	%	KWH	Cost	CO^2	%
Today	187.3	$24.35	93 lb	-144.3	$-18.76	-72 lb	77%	43	$5.59	21 lb	23%
Yesterday	366.9	$47.7	182 lb	-214.7	$-27.91	-107 lb	58.5%	152.2	$19.79	76 lb	41.5%
This Week	1964.6	$255.4	976 lb	-1107	$-143.91	-550 lb	56.3%	857.6	$111.49	426 lb	43.7%
This Month	187.3	$24.35	93 lb	-144.3	$-18.76	-72 lb	77%	43	$5.59	21 lb	23%
This Year	83612.2	$10869.59	41555 lb	-38439.6	$-4997.15	-19104 lb	46%	45172.6	$5872.44	22451 lb	54%
Lifetime	275358.2	$35796.57	136853 lb	-139503	$-18135.39	-69333 lb	50.7%	135855.2	$17661.18	67520 lb	49.3%

Systematic review of documents provided by EcoVillage at Ithaca Inc. show that for FROG, where the ground mounted array is installed provided the following information.

The FROG neighborhood has 30 homes which share the output of a 50KW ground mounted photovoltaic (PV) solar array. In addition, the common house building has its own 6KW PV installation (which includes battery backup for outage protection). Additionally 4 shared "energy centers" provide heat and hot water through hydronic pumped loops to the houses.

Overall, the FROG neighborhood used 144,909KWH KWH in 2013, divided between 30 households equals 4,830 KWH per household. The ground mounted solar provided 42% all of the electricity for neighborhood or the equivalent of approximately 13 EcoVillage homes that year or approximately 15 homes in a normal year (see limitations below). EVI homes use approximately a third less electricity than a typical home in NY where the state average is 7200 KWH per year.

2013 Summary Data for the FROG neighborhood

	Usage	**PV Generation**	**Net Usage**	**PV Percent**
Household usage (30 homes):	122,537	-58,103	64,434	-47.42%
Common House Usage:	10,900	-3,320	7,580	-30.46%
Heating system usage:	11,472	0	11,472	0.00%
Total Usage:	**144,909**	**-61,423**	**83,486**	**-42.39%**

Limitations: Power generation from 50K PV array was down for 2013 because of a wiring problem that took 1/4 of the array offline for a few months, so percentages for that year are a lower than expected. Normally, the PV power generation is expected to provide closer to 50% of the neighborhood's needs. The comparison of electricity generated to energy use per household in New York State is based on a statewide average of 600kWh per month, described as a typical electrical bill by NYSEG. Individual usage will vary based cultural differences, especially in a community like EcoVillage, focused on reducing individual impacts.

Social

Performance Indicator 7:

- *Increases awareness of sustainable living practices by hosting about 1,000 visitors per year through monthly tours. 85% of surveyed tour attendees said that their visit to EcoVillage increased their understanding of clustered housing.*

Methods: Information collected through a systematic review of documents provided by EcoVillage at Ithaca Inc. and a survey of tour participants on June 28, 2014 and July 26, 2014. The survey results are shown below:

Sustainable practices Mentioned in Survey:

- Densely clustered housing
- Peripheral parking (no individual driveways, garages or on-street parking)
- Car-pooling / ridesharing
- Telecommuting or working from home
- Sharing utilities with neighbors (heating, electricity, etc.)
- Limiting individual and family consumption (water, electricity, etc.)
- Separated garbage collection and pre-sorting (recyclables, compost, etc.)

	#	%	#	%
	Respondents Likely to Adopt…		**Respondents Showing Stronger Support for…**	
1 Practice	1	3.7%	1	4%
2 Practices	4	14.8%	6	24%
3 Practices	8	29.6%	5	**20%**
4 Practices	6	22.2%	4	**16%**
5 Practices	2	7.4%	3	**12%**
6 Practices	4	14.8%	0	**0%**
7 Practices	0	0%	2	**8%**
Responses	27	100%	25	100%

Please indicate how strongly you agree or disagree with the following statements:
"My visit to EcoVillage today has increased my understanding of..."

(N=26)	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Clustered housing development (closely packed houses, limited roadway, large portion of land conserved or farmed).	42.3%	42.3%	15.4%	0%	0%
Co-housing practices (shared meals, sharing, carpooling, etc.).	42.3%	38.5%	19.2%	0%	0%

Survey Notes:

- Nine EcoVillage visitors responded to the survey on June 28, eight visitors responded on August 12, and ten visitors responded on August 22.
- AGE: 22.2% aged 18-24, 7.4% aged 25-44, 37.0% aged 45-64 and 29.6% 65 years or older.
- TRAVEL DISTANCE: 0% less than one mile, 0% 1-10 miles, 11.1% 11-50 miles, 29.6% 51-100 miles, 55.6% more than 100 miles.
- HUSEHOLD SIZE: 18.5% one member, 48.1% two members, 0% three members, 18.5% four members, 11.1% five or more.

Limitations: The limited sample size in this survey (N=27) may introduce some error or bias based on the respondents that happened to tour EcoVillage on those days.

Economic

Performance Indicators 8-9:

- *Generates a gross annual revenue of $233,500 in organic produce sales on two farms, providing CSA shares for approximately 1000 people during the growing season.*
- *Created 7 full-time-equivalent (FTE) farm jobs during growing seasons, and 2.5 FTE during winter, as well as several part-time seasonal jobs.*

The two farms at EcoVillage, West Haven Farm and Kestrel's Perch Berry Farm act somewhat like concessions. Resident farmers lease the land from the community for the cost of land taxes. Produce is sold to members of the EVI community as well as the larger Ithaca community in several ways. West Haven sells CSA shares for the entire growing season and sells any excess at a local farmer's market. Kestrel's perch is a U-pick berry farm. The farms further a goal of the EVI community to keep local farmland productive with low input farming methods. Farms are irrigated with pond water and are completely organic with no pesticide or commercial fertilizer use.

Methods: Systematic review of documents provided by EcoVillage at Ithaca Inc. *EcoVillage at Ithaca: Principles, Best Practices & Lessons Learned* (Liz Walker for EPA Climate Showcase Communities Grant, January 2012)

Limitations: All data is self-reported and may vary from year to year.

Sustainable Features:

- *Provides a research model for sustainable development through the EPA Climate Showcase Communities program.*

The EPA Climate Showcase Communities program leverages EcoVillage's local success story to promote and study denser development and low impact lifestyles which preserve or enhance quality of life. Through the grant program, EcoVillage's sustainable philosophy has been shared to over 4700 people who attended public workshops and meetings, presented by Tompkins County Planning and grant partners. The Community-that-works.org website has had more than 9,500 visits in the 12 months from July 2013.

Cost Comparison:

Capital Cost Comparison:

- *The EVI development's estimated cost is $2.4 million for materials and activities related to the site and landscape. A conventional suburban development of 100 homes would cost $8.3 million for the site/landscape. This represents a 70% savings.*

Methods: Initial capital costs are compared between the developer plan for the conventional subdivision and the clustered development at EVI. The comparison between site development costs for EcoVillage and the conventional subdivision planned for the same property began with the area-takeoffs taken based on the strategy outlined in the plat plan comparison methodology. These areas were then combined with unit costs from R.S. Means, local bid information and professional experience. The same unit process were used in the comparison.

COST ESTIMATE					
Description	**Quantity**	**Unit**	**Cost/Unit**	**Subtotal**	**Total**
Site Clearing					$140,000
Clearing & grubbing, cut & chip light trees, to	35	Acre	$4,000.00	$140,000	
Earthwork					$537,750
Earthwork (3 Neighborhoods)	30,000	CY	$15.00	$450,000	
Earthwork Roads (assumes 8" depth of gravel	5,850	CY	$15.00	$87,750	
Entrance Improvements					$16,250
Entrance Asphalt Apron (22' Wide)	2,500	SF	$6.50	$16,250	
Driveway and Parking					$930,544
Gravel Drive 8" depth w geotextile	232,636	SF	$4.00	$930,544	
Paved Sidewalks					$136,345
Cold Process Asphalt (FROG Neighborhood	6,790	SF	$5.50	$37,345	
Allowance for sidewalks from neighborhood	18,000	SF	$5.50	$99,000	
Site Restoration					$140,000
Topsoil and Seeding (assumes stipped and	17,500	SY	$8.00	$140,000	
Landscape					$500,000
Individual Home Landscape, allowance	100	L.S.	$5,000.00	$500,000	
SUBTOTAL COST					**$2,400,889**

Estimate for EcoVillage (Three Neighborhoods and Village, 100 residences)

COST ESTIMATE					
Description	**Quantity**	**Unit**	**Cost/Unit**	**Subtotal**	**Total**
Site Clearing					$470,400
Clearing & grubbing, cut & chip light trees, to 6"	118	Acre	$4,000.00	$470,400	
Earthwork					$171,735
Earthwork (lots, assumes same as EVI)	30,000	CY	$15.00	$450,000	
Earthwork (Roads, assumes 12" depth of pavement)	11,449	CY	$15.00	$171,735	
Roadways					$2,316,623
Asphalt Paving (based on roads drawn on plat plan)	308,883	SF	$7.50	$2,316,623	
Residential Driveways					$660,000
Asphalt Paving (1,100 s.f. per home)	110,000	SF	$6.00	$660,000	
Residential Sidewalks					$325,000
Concrete Sidewalk, light duty (500 s.f per home)	50,000	SF	$6.50	$325,000	
Site Restoration					$2,365,792
Topsoil and Seeding (70% of lot coverage, assumes	295,724	SY	$8.00	$2,365,792	
Landscape					$500,000
Individual Home Landscape, allowance	100	L.S.	$5,000.00	$500,000	
SUBTOTAL COST					**$6,809,550**
Contingency	10%				$680,954.95
General Requirements and Mobilization	12%				$817,145.94
TOTAL ESTIMATED CONSTRUCTION COST					**$8,307,650**

Estimate for Conventional Suburban Plat Plan (100 One-acre lots)

Methods: The comparison between construction costs at EcoVillage and the conventional subdivision planned for the same property was completed using area-takeoffs based on the strategy outlined in the plat plan comparison methodology. These areas were then combined with unit costs from contemporary estimates for other projects, conversations with the EVI design team and construction manager for the project and R.S. Means. Therefore, in order to make a fair cost comparison, the same unit prices were used for both EVI and for the Plat plan though according to Michael Carpenter, Construction Manager for TREE, lower unit prices have been negotiated on some items. He believes that setting up a work environment that lowers the contractor risk for unknown costs has led to better prices for the TREE project. Prices to build the overall neighborhood, including the homes, has come in at 20-25% lower than expected in construction estimates.

Limitations: Refer to Introduction for limitations associated with area takeoffs. No comprehensive cost estimates exist for EVI, partially because of the phased nature of the project and the time that has elapsed. TREE estimates are hard to decipher and were deemed unusable as they lumped entire costs for items with no unit prices. The estimates should be considered conceptual in nature but are as accurate as possible in terms of the quantities. The cost estimates developed in this study are not inclusive of all possible costs associated with site development but only include those that can be estimated from the area takeoffs from the plat plan and sample 1 acre lot. No stormwater

management, utility or grading associated with building foundations are included. The earthwork cost included was based on an engineer's estimate for the earthwork for TREE and multiplied for the three neighborhoods. The same amount of earthwork was assumed for the conventional plan but it is likely that it would have generated more earthwork than EVI.

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Resources:

Allen-Gil, Susan, Bardaglio, Peter W., and Walker, Liz. *Educating For Sustainability: Ithaca College and EcoVillage at Ithaca*, 2005.

Dream Home Source
http://www.dreamhomesource.com/house-plans/dhs/dhsw64158.html?from=search

The Center for Watershed Protection, 3290 North Ridge Road, Suite 290, Ellicott City, MD 21043
http://www.cwp.org/ http://www.cwp.org/online-watershed-library/cat_view/65-tools/91-watershed-treatment-model

EcoVillage, *Island Agreement*, June 2010, document that outlines agreements between the three neighborhoods and the Village Association.

Franke, Richard W, *EcoVillage Fact Sheet*, October 28, 2012.

Generic Environmental Impact Statement, July 2001, prepared by EcoVillage at Ithaca, Inc. and Trowbridge & Wolf Landscape Architects.

I-Tree Eco, http://www.itreetools.org/eco/

LEED Building Rating System, http://www.usgbc.org/leed

Reed Construction Data 2014, R.S. Means Online, cost estimating figures. http://rsmeansonline.com/

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Welcome Home: Community That Works, http://community-that-works.org/