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# A Resilient Suburbia? 3: Weighing the Potential for Self-Sufficiency

Posted by jeffvail on November 24, 2008 - 1:07pm
Topic: Environment/Sustainability
Tags: gardening, original, photovoltaics, rainwater harvesting, self-sufficiency, solar power, suburban energy, suburban gardening, suburban water, suburbia [list all tags]

**A backyard garden in Oregon**

Over the past two weeks, I have examined the challenges facing suburbia in a post-peak world. I've argued (in Part 1) that financial reality will prevent us from building an alternative to suburbia, and (in Part 2) that the superficial transportation issues facing suburbia are better viewed as a much broader economic threat posed by peak oil that equally threatens urban and suburban living. In this post, I'll look at some of the unique advantages of our present suburban arrangement—is it possible that suburbia not only won't be abandoned post-peak, but that peak oil will act as a catalyst for the adaptation of suburbia into a flourishing, vibrant built environment? I think it's possible, but that it will be challenging. In this post I'll explore this possibility—both the potential, and the challenges—of creating A Resilient Suburbia.

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Specifically, this post will look at the potential of suburbia to produce some degree of self-sufficiency in food, water, and energy. At one extreme, if suburbia can sustainably produce 100% of the food, water, and energy, then the prospects are excellent for a resilient suburbia.

While true self-sufficiency may be theoretically possible, I don't think this goal is realistic. Some degree of self-sufficiency, however, is possible. While the majority of this post will address the potential, and challenges, of attaining different degrees of self-sufficiency, there are two additional issues that must be addressed.

First is the degree of self-sufficiency relative to urban settlement. Suburbia is (in virtually all instances) a more energy intensive form of civilization than urban settlement. If, however, after adding the potential resource production of suburbia into the equation, suburbia has the potential to be less net-energy intensive than urban settlement (which, in almost all circumstances, has a lower potential for resource production), then suburbia would be, on balance, more sustainable than urban settlement.

Second, a point which I will raise now but leave unaddressed until next week's post, is the function of economic coordination. Urban settlement, by its very nature, sits atop a large pyramid of control and dependency--in isolation it is less energy intensive, but it depends on a vast hinterland, the energy requirements of which are often ignored in calculating the sustainability of urban living. Suburbia, in contrast, has the potential to evolve into a flatter, more inclusive mode of civilizaiton (it certainly isn't there now!). Traditionally, urban areas, by virtue of their geographic density, best serve the critical function of coordinating economic activity in a hierarchal fashion. While this function—its costs, benefits, and alternatives—must be considered in weighing the sustainability of different modes of the built environment, I'll ask that we focus discussion on the first topic for this week's post.

## 1. Food:

How much of its own food can suburbia produce? In America, the average suburban lot size is approximately 12,000 square feet. That's about a quarter-acre. At an average of 2.56 people per household, and a rough average of 10,000 feet per lot not covered by structures, that's just under 4,000 square feet of yard per person. Of course, this ignores the potential for parks and other open spaces in suburbia to be converted to food-production. It is also an average figure—some neighborhoods will have far less space, others far more. Despite these sources of variability, it is a good jumping-off point. Is 4,000 square feet enough to provide for a person? There are three requirements: calories, nutrition, and the variety and selection necessary to support culture and quality of life. In addition, there are four limiting factors to food production in a given area: sunlight, water, labor, and soil/nutrients. In the interest of space, I'll only address three of these: calories, nutrition, and soil/nutrients—please feel free to discuss the other requirements and constraints in comments.

Can 4,000 square feet produce enough calories to feed one person? At 26 calories per ounce and roughly 8,000 pounds of potatoes harvested from 4,000 square feet (based on intermediate yields from John Jeavons "How to Grow More Vegetables," p. 92), that's 3.3 million calories, or 9,000 calories per day. This is, of course, completely unsustainable, insufficiently nutritious, etc. But it does answer the question—it is possible to grow enough calories on 4,000 square feet per person. The real limiting factors are nutrition and soil, discussed below:

Can 4,000 square feet produce enough nutrients to feed one person while simultaneously sustaining and improving the soil? One issue is that topsoil has been scraped away from more recent suburban developments. How effectively can we re-build soil, and how long does it take? John Jeavons has addressed this question in depth (summarized at p. 28-29 of "Grow More Vegetables"). He concludes that 4,000 square feet is roughly enough to feed one person a complete, nutritious diet, while simultaneously improving soil quality. His method involves 60% (by area) focus on growing soil-improving crops (high carbon content food crops for eventual compost), 30% mixed high-calorie root crops, and 10% mixed vegetables.

I'm sure Jeavons' is one of many possible ways to approach the problem. One alternative is forest-gardening, depending largely on fruit and nut production from long-lived trees coupled with understory vegetable and root crops. Another, more high-tech route is hydroponics. While I anticipate a lively discussion on these points, I'll cut my presentation short, closing this point on a simple thought: Jeavons (a practicing expert in the area) argues that 4,000 square feet is realistic. My mother (admittedly, a Master Gardener) is doing exactly this in her roughly 5,000 square foot home garden. I don't claim it will be easy. I don't even argue that suburbia can consistently provide 100% of its food production. But I do argue that suburbia can realistically provide around 50% of its food, can act as a localized buffer against disruptions, and can provide a high percentage of vitamins, minerals, flavor, and culturally-important foods.

Critically, while attaining self-sufficiency on suburban lots may not be easy, it is certainly more practical to obtain a significant degree of food self-sufficiency in suburbia than it is in urban settings. This isn't to say that urban areas shouldn't explore gardening possibilities—it is simply to point out that suburbia's food-production potential is an asset when compared to urban settlement. Whether or not its food-production advantage outweighs its transportation disadvantage is not clear—but more on this later.

## 2. Water:

In the next century, water will be one of the most critical, and scarce, resources for many parts of the world. Even in those areas where there water supplies are plentiful, there is a significant energy requirement to build, maintain, and operate the infrastructure required to gather, store, transport, and purify water. How realistic is it for suburbia to provide its own water, both for domestic use and for suburban gardening?

Many people will initially object to the potential for suburban water self-sufficiency on the grounds that rainfall is erratic, and that some areas of the country are quite arid. While it isn't the Atacama Desert, skeptics should read Brad Lancaster's excellent guest-post on rainwater harvesting in Tucson, Arizona (average 12" of rainfall per year). For several years now, Lancaster has been using simple rainwater harvesting techniques at his modest suburban Tucson residence to harvest sufficient rainwater for both domestic needs and to sustain an impressively productive garden. The average suburban home has a roof area of roughly 2000 square feet (garage roofs and overhangs count here, but not on home square footage). In Tucson, with 12" of rain per year, that catches as much as 14,000 gallons per year (or 40 gallons per day)—more than enough for frugal domestic usage by one family, though certainly not enough for several hot baths, a backyard pool, and multiple loads of laundry daily. In wetter climes—say, Ohio with 37.77 inches per year on average--the potential is even more clear.

Two concerns for rainwater harvesting are droughts and purification. Lancaster's article, and his several books on the topic, address both in depth. Bottom line: storage and purification are relatively simple, cheap, and require little energy, though the solutions are by no means fool-proof. In perhaps one of the greatest differences between suburbia and urban areas, suburbia has the clear potential to be water self-sufficient, whereas dense urban areas do not.

## 3. Energy:

What about the potential for suburbia to produce its own energy—for heating, cooling, cooking, lighting, and transportation? While suburban homes tend to use more energy than urban homes —for all of these requirements, with the possible exception of cooking—does their potential to produce energy compensate for this?

Let's start again with the average roof area of a suburban home: about 2,000 square feet, or roughly 780 square feet per person. Solar photovoltaics have the potential to produce roughly 180 Watts per 15 square feet, or 12 Watts per square foot (one sample spec sheet - .pdf). That works out to about 24 KW per house, or about 9 KW per person. Cut that by two-thirds to confine placement to properly oriented sections of the roof, and the average suburban home can install roughly 8 KW of photovoltaic panels (or 3 KW per person). What percentage of a home's energy needs would that provide? First, it's important to note that 1 KW of installed capacity doesn't equal 1KW-Hour of production for every hour of sunlight—it provides significantly less, depending on location and weather. Based on a very informal survey of conservation-aware households, a WAG is that 20 KW-Hours per day, per household is realistic (probably conservative) for suburban electricity usage with some focus on conservation. Using the rough metric of 1300 KWh per year from 1 KW installed capacity, our hypothetical suburban household would require 5.6 KW of solar capacity. In other words, there's plenty of roof space in suburbia to meet suburbia's electricity demand. Two important caveats: 1) such a system won't provide power when suburbanites currently use it (a net-metering system paired with other forms of generation would be necessary), and 2) while some households use electricity for home heating, water heating, and cooking, in many areas and homes it simply isn't realistic to heat a home with 5.6 KW of installed solar power only.

While I've been focusing on photovoltaics (actually one of my less-favored forms of renewable energy) because they're readily available and easily understood, I think that solar hot water, passive solar heating, and increasing insulation and on-demand ventilation are actually more promising means for suburbia to generate its own power. By combining passive solar hot-water and air heating with sufficient thermal mass and improved insulation and sealing, it is possible to provide nearly all energy requirements for the vast majority of suburban homes using only that home's roof space. Urban homes often lack one of the key features of suburbia: plentify solar access. The vast majority of suburban roofs have excellent solar access--though some tree-pruning may be required. Even moderately dense apartment blocks (not to mention high-rise residential) does not have the necessary insolation to power itself through in a distributed fashion. In the interest of space, I'll leave discussions of home geothermal and heat pumps (promising), home wind-power (less promising), and home wood-lots (less promising) for another day.

While these kinds of retrofits cost money, by improving the viability of suburban homes they don't face the same kind of financial Catch-22 addressed in the first post in this series (whereby it isn't possibly to finance alternatives to suburbia because credit markets are tied to the value of suburbia that is destroyed by the creation an alternative).

Additionally, it isn't realistic at present to think that we'll be able to put enough solar panels on our roofs to charge the batteries on the twin electric-Escalades sitting in our garage for the daily commute to work. I increasingly believe that suburbia can be resilient and sustainable, but not as a mere "Star-Trek" version of the present. Rather, by minimizing our travel requirements at the outset, and then transitioning to high-efficiency vehicles, ridesharing, bicycles, and especially electrified rail for remaining journeys, suburbia can adjust to a radically lower transportation energy-budget.

## Conclusion

Suburbia has a significant potential to provide its own food, water, and energy. It won't be as simple as snapping our fingers. And it likely won't be possible for suburbia to consistently produce 100% of its needs. But I think one thing is quite clear: the potential increase in suburbia's self-sufficiency is significantly greater than the potential for urban areas to increase their self-sufficiency in food, water, and energy. We can argue the degree to which this is the case, but I'll be interested to see if anyone seriously disputes the issue generally. If we accept that suburbia has greater potential for self-sufficiency, and if we accept that suburbia requires more energy for transportation and transportation infrastructure in its current manifestation, then the big question is this: does suburbia's advantage in potential self-sufficiency outweigh its disadvantage in transportation? It's quite easy to toss out an unsupported opinion on the answer--I won't attempt to do so, and I'll caution that anyone who does, without empirically and irrefutably answering the potential for suburban self-sufficiency, is just guessing. The answer partially turns on the degree to which suburbia can convert itself away from a commuter model and toward a knowledge-based, distributed production model. It also, as I'll discuss next week, turns on the value of distributed ownership and self-sufficiency as a force in determining the political structure and evolution of civilizations.