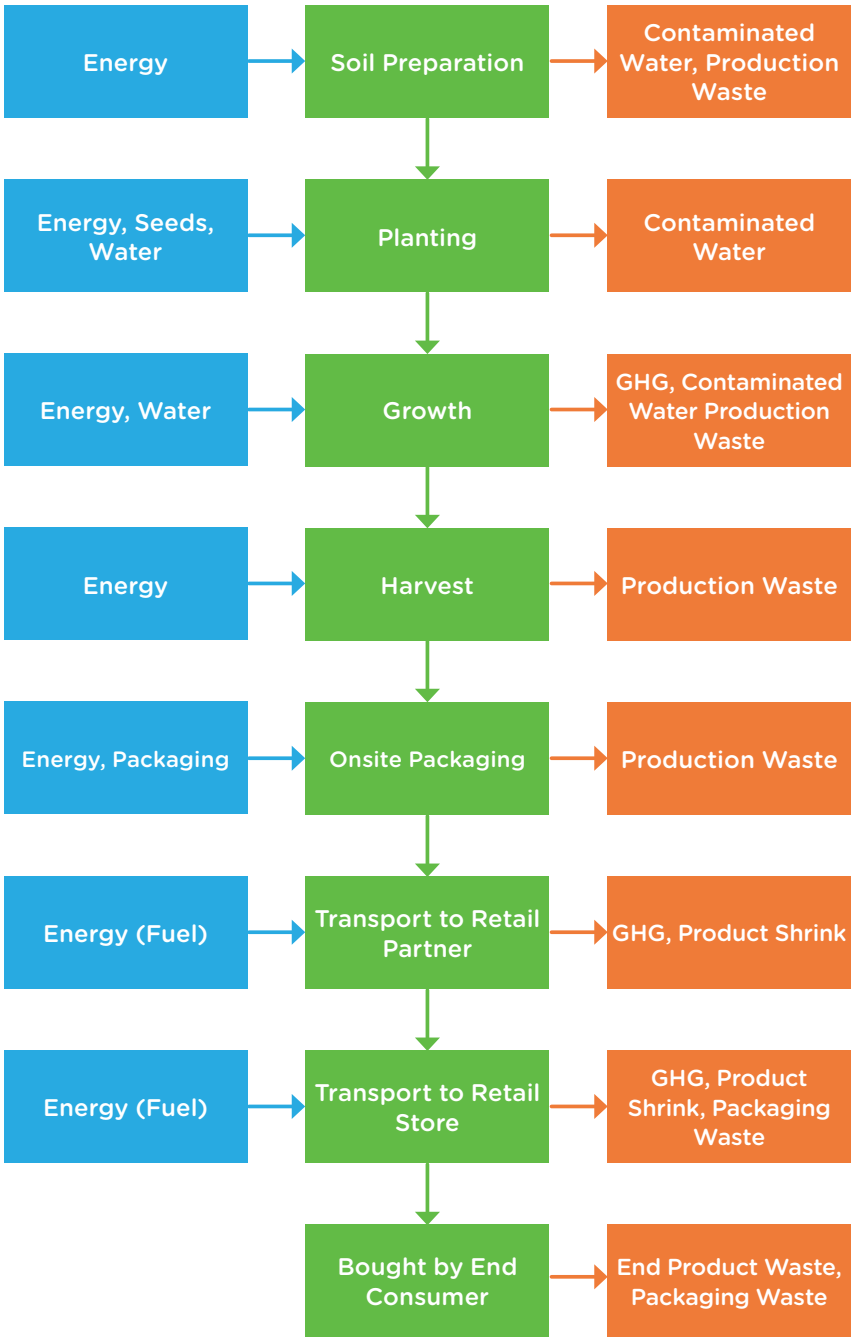
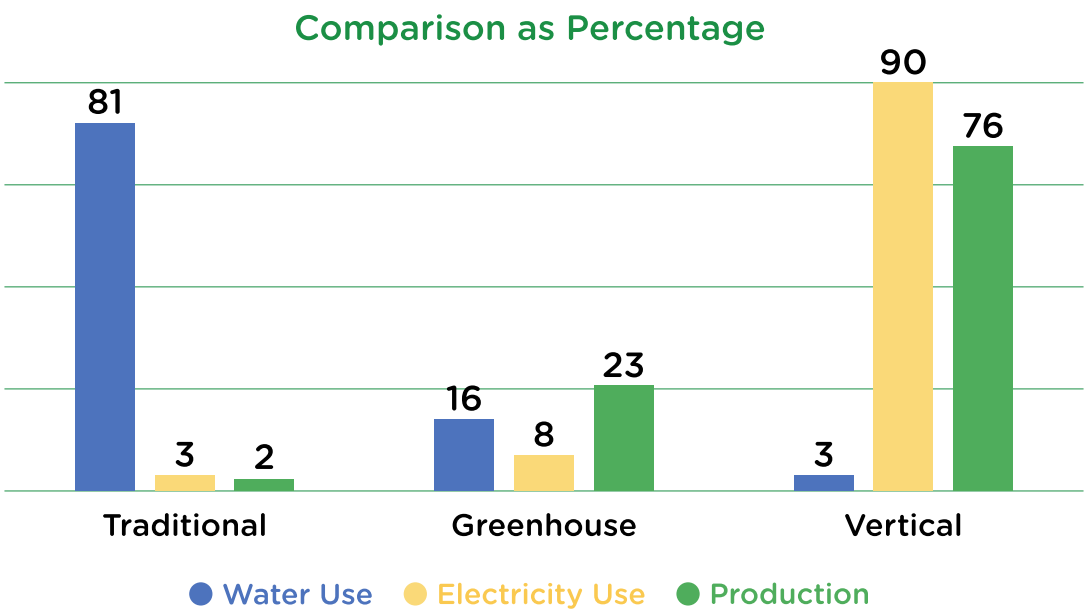
Local Bounti Comparative Lettuce Growth Analysis

This summary analysis defines the comparative environments and explains the basic life cycle assessment (LCA) for the growth of lettuce in a traditional farm, a greenhouse, and a vertical farm setting. This comparison will address the energy use for growth and transportation, water use, and waste for each method.

Traditional farming is the most used method for growing lettuce in the United States. This is done mostly in Arizona and California, which allows for year-round growing. Less used methods include vertical farming and greenhouse farming. Vertical farms, also called plant factories, are environments where plants are grown using artificial light and climate control in large vertical stacks. Greenhouses are environments that use a combination of natural and artificial lighting and climate control in a wider area. Both tend to use hydroponic systems to replace soil for a higher degree of control over inputs. Input amounts for these methods vary for each method.





The above graph was created by adding the average use numbers for each category (water, electricity, production) and turning them into a percentage to better compare the methods. As indicated above, water use decreases as energy use increases for each method, and energy use tends to increase with production level, with vertical farming using far more energy than other methods, but also producing a larger amount in the same amount of space with much less water. The table below shows water use in gallons/lb, energy use in kWh/lb, and production total in lb/ft2/yr.

	Water (gal/lb.)	Energy (kWh/lb.)	Production (lb./ft²/yr)
Traditional Farm	420,887	407,310	.05
Greenhouse	71,228	3,637,260	7.5
Vertical Farm	-349,659	3,229,950	25

The electricity use shown in the comparison graph shows the single factor that traditional farming does better than greenhouse farming and vertical farming. Due to using sunlight and drip irrigation systems, electricity use from traditional farming is much lower than greenhouses and vertical farms. The greenhouse also makes use of sunlight but supplements it with artificial lighting and uses climate control systems, while the vertical farm requires individual artificial lighting for each stack of plants being grown, meaning a massive increase to electricity use. However, traditional farming uses much more fuel to harvest and transport than greenhouse and vertical farming.

Waste (% of end product)	Growth	Harvest	Transport	Total
Traditional Farm	6%	4%	4%	14%
Controlled Alternatives	0%	3%	0%	3%

The table above indicates how controlled environments, such as greenhouses and vertical farming, perform better than traditional farming. The controlled environment prevents pests and inclement weather from damaging crops, causing drastically less crop loss during growth, and as mentioned above, the shorter transportation distance requires less storage and causes less waste due to product spoilage or potential damage during transport.

Greenhouses and vertical farms tend to use hydroponic or similar systems, which grow plants in water instead of soil. This leads to lower fertilizer use and less GHG contribution. It also allows for control over contaminated water runoff, which leads to a lower environmental impact.

Local Bounti combines aspects from both greenhouse farming and vertical farming as described above. Using a vertical setup for initial seedling growth, then switching to a greenhouse setting to finish allows Local Bounti to increase their production to a level closer to a vertical farm setting while retaining a power use rate closer to a greenhouse setting. These metrics were obtained by measuring power and gas use through local utility companies and comparing the data to average power use for vertical farms and greenhouses.

References

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