

FAYETTEVILLE 2030: FOOD CITY SCENARIO

University of Arkansas Community
Design Center



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“The study of food is really part of the humanist curriculum.”—Evan Fraser & Andrew Rimas, *Empires of Food: Feast, Famine, and the Rise and Fall of Civilizations*

Executive Summary

The City of Fayetteville is located in Northwest Arkansas—the most prosperous region of the state. Yet, Northwest Arkansas has one of the highest rates of child hunger statewide, while Arkansas itself has the highest rate of child hunger nationally with nearly 25 percent of children food insecure. By comparison, in 2010, 14.5 percent of U.S. households were food insecure. But Arkansas is awash in food.

Arkansas is the leading producer of rice in the U.S., providing 46 percent of the nation's supply; ranks 2nd in the nation for broiler (chicken) production, 3rd for catfish and turkey production, 5th for sweet potatoes, 6th for grain sorghum, 9th for soybeans, 10th for chicken eggs and pecans, 11th for beef cows, 12th for tomatoes, 13th for blueberries and grapes, 14th for watermelons, 20th for wheat, 21st for corn, oats, and peaches, and 24th for hogs and pigs. Northwest Arkansas is home to Tyson Foods—the world's second largest protein producer—as well as to Walmart, the nation's largest grocer. Sixteen percent of the state's economic production comes from agriculture, and Arkansas ranked 14th nationally in 2010 agriculture cash receipts. However, access to locally-produced and affordable food are obstacles to meeting the essential well-being of many residents. *Fayetteville 2030: Food City Scenario* then is a social, environmental, and economic prosperity building proposal to integrate the culture and economics of sustainable food production back into urban design to serve local populations.

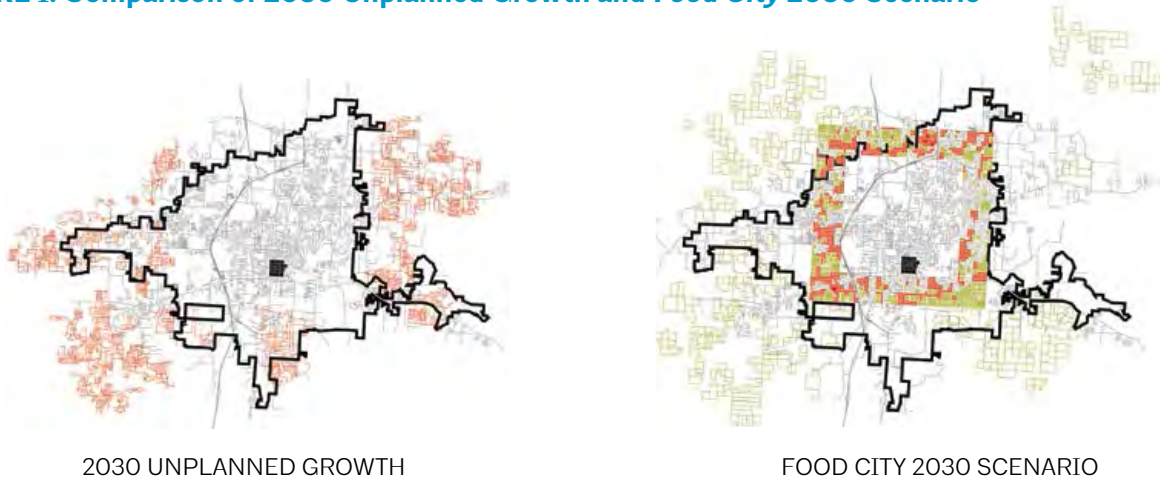
What if Fayetteville's new development enabled the city to sustain its food budget through a local urban agriculture network?

Food City devises a model transition vocabulary for developing an urban food production system beyond the scale of the individual garden. The scenario plan envisions the foodshed as an ecological municipal utility, featuring green infrastructure, public growscapes, and urban spaces related to food processing, distribution, and consumption. *Food City* reclaims a missing middle *scale* of agricultural land use between the backyard garden and the industrial farm.

Fifty percent of Fayetteville's built environment projected to exist by 2030 has not yet been built; the city will nearly double its population of 75,000 over the next 20 years (Figure 1). Complementing the city's 2030 Comprehensive Plan, *Food City* envisions a future based upon greater food security with accompanying forms of resilient urbanism that link food production and place-making. While the dense metropolis engenders the leanest carbon footprint per capita from efficiencies in shared transportation and housing, small cities also sponsor niche solutions in creating a low-carbon future. Only the small city can plausibly evolve the local food-secure environment necessary to achieve resiliency (vs. efficiency) given the interconnectedness of its natural ecosystems, infrastructure, and urban pattern gradients.

Food City formulates an agroecology of urban growing guilds associated with various scales, functions, and agencies bound by context. The five growing guilds

FIGURE I. Comparison of 2030 Unplanned Growth and *Food City* 2030 Scenario



The current sprawl scenario develops 300 miles of new roads over prime agricultural land. This scenario is characterized by automobile-oriented development.

Food City establishes a middle scale fabric of food production through a greenbelt that intensifies agricultural systems and urban densities at 15 units per acre along Fayetteville’s patchy ring road landscape.

tailored to urban areas are: **1) permaculture/foraging landscapes**, like edible forest farms, related to successive perennial landscapes and hosted by existing woodlands; **2) farming and gardening** requiring intensive management of primarily annual landscapes; **3) GROW Streets (Gardened Right-of-Way)** associated with public right-of-ways involving orchard-lined streets, fruit and nut boulevards, and edible front yards; **4) pollution remediation landscapes** that support safe urban growing, primarily through low impact stormwater management, and carbon sinks for metabolizing air pollution; and **5) waste-to-energy districts** which upcycle concentrated waste streams.

The planning approach employs successional urbanism to evolve recombinant forms of town and country. *Food City* re-establishes a middle scale fabric of food production through a greenbelt that intensifies agricultural systems and urban densities at 15 dwelling units per acre along Fayetteville’s patchy ring road landscape. The greenbelt catalyzes a successive wave of 2030–2080 growth toward urban core infill resulting in a “mat agricultural urbanism” that thoroughly institutionalizes food production through new agricultural urban real estate products.

Food City devises agricultural urban real estate products as value-added to the nineteen mainstream real estate

product types financialized by Wall Street (e.g., build-to-suit-offices, apartments, subdivision housing, big box retail, storage facilities, multi-tenant bulk warehouse, medical offices, and motels). The proposed agricultural urbanism real estate products constitute special community “third places”—neither home nor workplace—given the powerful social force of food.

Food City reintroduces the option of local food production as Fayetteville upgrades its codes to facilitate urban agriculture. The project team collaborated with the city and nonprofit groups tasked with overcoming hunger and poverty. In addition to growing strategies, *Food City* integrates upcycling strategies in energy harvesting and waste management, a portfolio of water, soil, and conservation strategies, and hybrid settlement patterns that blend productive landscape systems and urbanism. Design solutions address municipal-scaled nutrient management issues through composting networks, integrated waste recovery utilities, deep litter farming, and aquaculture toward building healthy productive soils, which takes years. Most importantly, *Food City* provides a planning framework for building a resilient community where a significant portion of the population experiences compounding distress brought by swings in the economy.

Introduction

“We have never seen food’s true potential, because it is too big to see. But viewed laterally it emerges as something with phenomenal power to transform not just landscapes, but political structures, public spaces, social relationships, and cities.”—Carolyn Steel, *Hungry City: How Food Shapes Our Lives*

Fifty percent of Fayetteville’s built environment projected to exist by 2030 has not yet been built. Fayetteville (pop. 75,000) will nearly reproduce another Fayetteville—approximately 100 million square feet including an additional 28,000 dwelling units—within its boundaries over the next 20 years. *Food City* not only envisions a future based upon greater food security, but proposes accompanying forms of resilient urbanism that link local food production and place making. Scenario planning visualizes possibilities unconsidered in conventional municipal planning processes, since conventional approaches, especially those in small cities, tend toward consensus building and assume stability in their drivers of growth. While the dense metropolis engenders the leanest carbon footprint per capita due to intrinsic energy efficiencies from shared transportation and housing, small to mid-size cities also sponsor niche solutions in creating a low-carbon future. Only the small to mid-size city can plausibly evolve the local food-secure environment necessary to achieve some degree of

resiliency given the interconnectedness of their natural ecosystems, infrastructure, and urban pattern gradients. Building upon this advantage, scenario thinking facilitates a more forward decision-making capacity among urban and rural interests alike to shape a planning approach marked by its adaptiveness to unpredictability, shock, and disruption—towards a greater prosperity.

Most cities have only a three-day supply of food sourced from globalized supply chains. “We are nine meals away from anarchy” as the saying goes. Markets structured around “just-in-time” delivery from concentrated supply are fragile organizations. They lack redundancy, modularity (scalable components) and proximity to multiple sources, making populations more vulnerable to supply disruptions from unforeseen failures in weather, transportation, food safety, and affordability. In *Food City* we ask: What if Fayetteville’s new development enabled the city to sustain its food budget through a local urban agriculture network? How might a local foodshed become an ecological utility in service to the city, featuring green infrastructure and neighborhoods, public growscapes, and urban spaces related to food processing, distribution, and consumption? What will the city look like, and how will it be structured once we incorporate forms of sustainable agriculture back into urban design? Most importantly, *Food City* reclaims a missing middle scale of agricultural land use between the backyard garden and the industrial farm. Middle scale agriculture is the key to sustaining a regional food system with related businesses, ecosystem functioning, and diverse food production.

The Missing Middle: Why Relocalize Food Production within the City?

Local governments provide public services through potable water supply, police and fire protection, sewage treatment, waste management, and transportation infrastructure. Similarly, how might a sustainable foodshed become an ecological utility scaled to community needs rather than an industrial economy? While the economics of industrial commodity farming and cheap food necessitated concentration of almost all agricultural processes outside the city, there are four compelling reasons to reintegrate some scales of agriculture back into the city.

1. ECONOMIC DEVELOPMENT: The convenience provided by proximity to growing systems demystifies farming and positions farming to be an incubator of local economic development through import substitution favoring local goods. Local production provides supply options for area demand while keeping profits in the community. Alignment of niche growers with unmet consumer needs stimulates new supply and demand networks—i.e., markets—through the “agglomeration effect” intrinsic to economic development in cities. Growers would also enjoy greater access to a robust labor pool while employees avoid consignment to an exclusively rural lifestyle.

2. HIGH-VALUE FOOD PRODUCTS: Urban land values encourage value-added specialty farming characterized by high-value production in plant diversity and nutritional content known as small plot intensive (SPIN) farming. SPIN farming optimizes economic return through advanced biodiversity and companion planting that makes small-scale agriculture feasible once again. With yields up to \$80,000 per acre (vs. \$7,000–8,000/acre average for commodity crops like rice and corn) some agricultural uses demonstrate returns equivalent to or better than those land uses with building improvements.

3. ECOSYSTEM SERVICES: Sustainable agriculture based upon ecological approaches to food production—agroecology—delivers community-wide ecosystem services including conservation and regeneration of urban

riparian corridors, legacy prairies and meadows, urban forest canopies, and wildlife habitat. Agroecology also entails life cycle accounting of nutrient and energy flows that support ecosystem and city functioning (Figure 2). Arguably, urban food production would not be practical were it not sustainable, considering conventional farming’s negative externalities (i.e., pollution, toxicity, odor, noise, and low-wage) and the amplification of their impacts on cities. Since the greatest ongoing challenge to planning is design within human-dominated ecosystems, resilient urban design will have to discover new ways of delivering the 17 ecological services found in all healthy ecosystems.

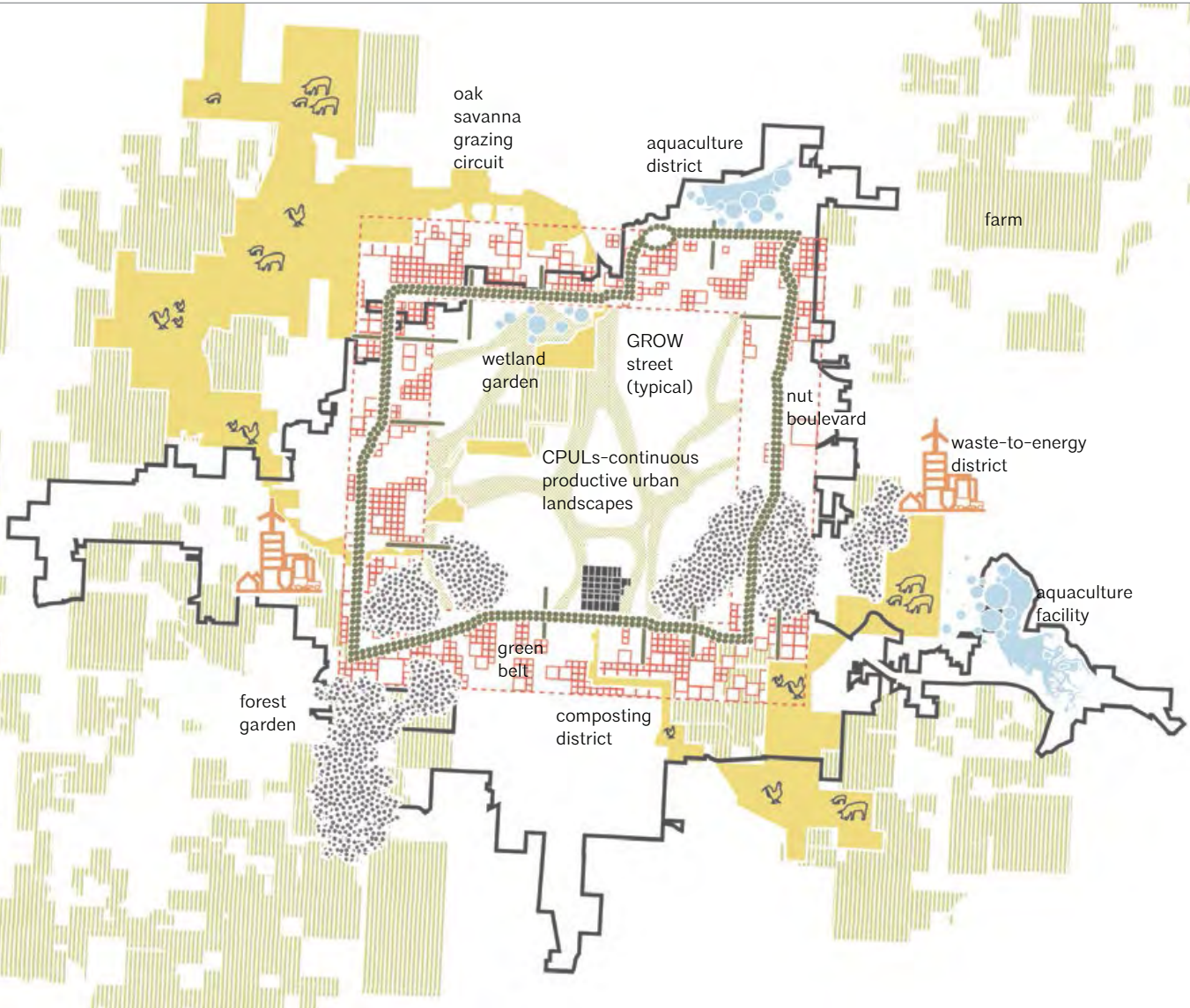
4. HEALTHY LIFESTYLES: Agriculture landscapes can contribute toward open space requirements that many cities struggle to meet, enhancing livability and exposure to nature otherwise unavailable through community harvesting, foraging, recreation, and wildlife watching. Agricultural urbanism promotes healthy lifestyles through development patterns that expand access to nutritious food options, agricultural and food literacy, and physical activity.

An Agricultural Urbanism Development Model: The Five Urban Growing Guilds

Sustainable farming functions as an ecosystem—a web of growing systems—that recharge natural carrying capacities in local landscapes. Sustainable farming mimics nature. Alternatively, industrial agriculture is a factory-like system of production that segregates monoculture growing systems dependent upon mechanization, intensive fossil-fuel inputs, and chemically-laden fertilizers and pesticides—all generating waste streams whose concentrations become toxic. “Every farm a factory” was the era-defining slogan coined by agricultural equipment manufacturer International Harvester. We now use ten calories of fossil fuel energy to produce just one calorie of food energy, the inverse from just 50 years ago. We are literally eating oil while depleting the availability of natural resources (top soil, minerals, fossil

FIGURE 2. Agricultural Territories: Patches, Mosaics, and Corridors

Sustainable farming begins with energy flows. *Food City* configures agricultural production territories with niche growing strategies based on opportunities in local geography, ecosystems, and public infrastructure.



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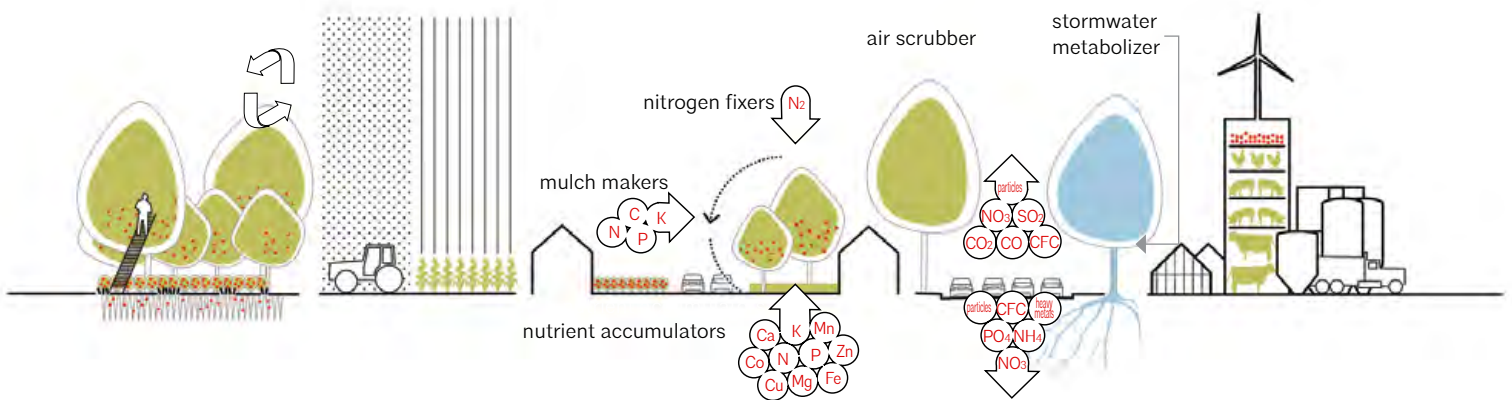
fuels, gene and seed pools, fresh water, etc.) upon which healthy cities depend. Unlike older traditions of farming, the isolated farmstead rather than the village became the basic unit of organization for modern American food production beginning in the 19th century. While concentrated growing systems won out over town-based distributed systems, there is a need for both. *Food City* then, devises a model transition vocabulary for reconnecting food production and the city, a distributed food-growing ecosystem hosted by the city beyond the scale and improvisation of the individual garden.

Food City formulates an agroecology of urban growing guilds associated with various scales, functions, and

agencies bound by context. The five growing guilds tailored to urban areas are: **1) permaculture/foraging landscapes**, like edible forest farms, related to successive perennial landscapes and hosted by existing woodlands; **2) farming and gardening** requiring intensive management of primarily annual landscapes; **3) GROW Streets (Gardened Right-of-Way)** associated with public right-of-ways involving orchard-lined streets, fruit and nut boulevards, and edible front yards; **4) pollution remediation landscapes** that support safe urban growing, primarily through low impact stormwater management, and carbon sinks for metabolizing air pollution; and **5) waste-to-energy districts** which upcycle concentrated waste streams from contributing operations as

FIGURE 3: The Five Urban Growing Guilds

- fortress plants protect from invasive flora and fauna
- insectary plants attract insect pollinators
- repellent plants secrete compounds to repel pests



1. PERMACULTURE AND FORAGING

Permaculture and foraging landscapes, like edible forest farms, are related to successive perennial landscapes and existing woodlands.

2. FARMING AND GARDENING

Farming and gardening requiring management of annual landscapes.

3. GROW STREET

GROW streets (Gardened Right-of-Way) are associated with public right-of-ways involving orchard-lined streets, fruit and nut boulevards, and edible front yards.

4. POLLUTION REMEDIATION

Pollution remediation landscapes support safe urban growing, primarily through low impact stormwater management, and carbon sinks for air pollution.

5. WASTE-TO-ENERGY

Waste-to-energy districts recycle concentrated production and consumption waste streams from some operations as energy for others.

energy inputs to recipient operations. While not all farming is conducive to urbanization, *Food City's* agroecology absorbs the city's advantages to deliver combined urban and ecosystem services.

Successional Urbanism: From Greenbelts and Continuous Production Urban Landscapes (CPULs) to Urban Mats

Cities were once fed by local food production embedded throughout towns and their countrysides. The planning approach employs successional urbanism to evolve recombinant forms of town and country instigated by food production. *Food City* re-establishes a middle scale fabric of food production through a greenbelt and CPULs that traverse the city through its riparian corridors, floodplains, productive soil zones, utility corridors, and existing trail system (Figure 1). Contrary to Ebenezer Howard's vision of the early modern greenbelt that combined farming and city-making, many greenbelts have simply become a buffer zone between isolated land uses—a terrain vague.

Unlike the standard entropic greenbelt that preserves underdevelopment in both nature and city at the urban edge, *Food City's* greenbelt intensifies agricultural systems and urban densities along Fayetteville's patchy ring road landscape (Figure 4). Current development patterns average one unit per acre, mostly at the city's edge. Targeting 15 dwelling units per acre—the threshold of public transit feasibility—this proposed greenbelt resuscitates the area's fledgling bus system by making bus rapid transit feasible (Figure 5). The urbanized greenbelt (a kind of anti-greenbelt) would catalyze a successive wave of 2030-2080 growth toward urban core infill resulting in a "mat agricultural urbanism" that thoroughly institutionalizes food production within city development (Figure 6). New agricultural urban real estate products will evolve within this green armature, creatively retrofitting suburban development, and upending our conventional perceptions that urban succession progresses linearly from core to periphery.

Agricultural Urban Real Estate Products as Third Places

Agricultural urban real estate products are the building blocks for evolving greater complexity in place making. *Food City* adds these hybrid alternatives to the nineteen standard real estate product types constituting mainstream land development (see *The Twenty-Two Agricultural Urban Real Estate Products*, page 15). Financialized by Wall Street through Real Estate Investment Trusts (REITs), these stand-alone product types, like build-to-suit-offices, apartments, subdivision housing, big box retail, storage facilities, multi-tenant bulk warehouse, medical offices, motels, etc., have been easy to finance, permit, and trade. But they have mostly produced sprawl. While *Food City* recovers urbanism and the advantages that attend the city, agricultural urbanism real estate products will have to demonstrate consumer appeal and financial worthiness. One point of marketability is *Food City's* reclamation of walkability in neighborhood design, the first step in facilitating greater physical and social activity toward improved general health. Because not all of their benefits can be monetized, agricultural urbanism real estate products' ultimate contributions will be value-added to conventional real estate products.

The proposed agricultural urbanism real estate products constitute special community third places—neither home nor workplace—given the powerful social force of food. Coined by Ray Oldenburg in his book, *The Great Good Place*, "third places"—taverns, barber shops, coffee shops, community gardens, etc.—are community anchors important for civil society, where a sense of place is constructed through social engagement. Agricultural urbanism real estate products are scalable and modulated, and thus capable of generating greater complexity as resilient networks demand. They can be plugged into conventional community landscapes to evolve a successional urbanism ever more supportive of local agricultural production over time. *Food City* proposes an urbanism from the following new real estate products.

FIGURE 4. Blocks

Agricultural urban fabrics restructure sprawl into neighborhood formats with clear centers and edges, anchored by public spaces. *Food City* recalls Ebenezer Howard's vision of the early modern greenbelt that combined farming and city-making—not the buffer zone of today's version.

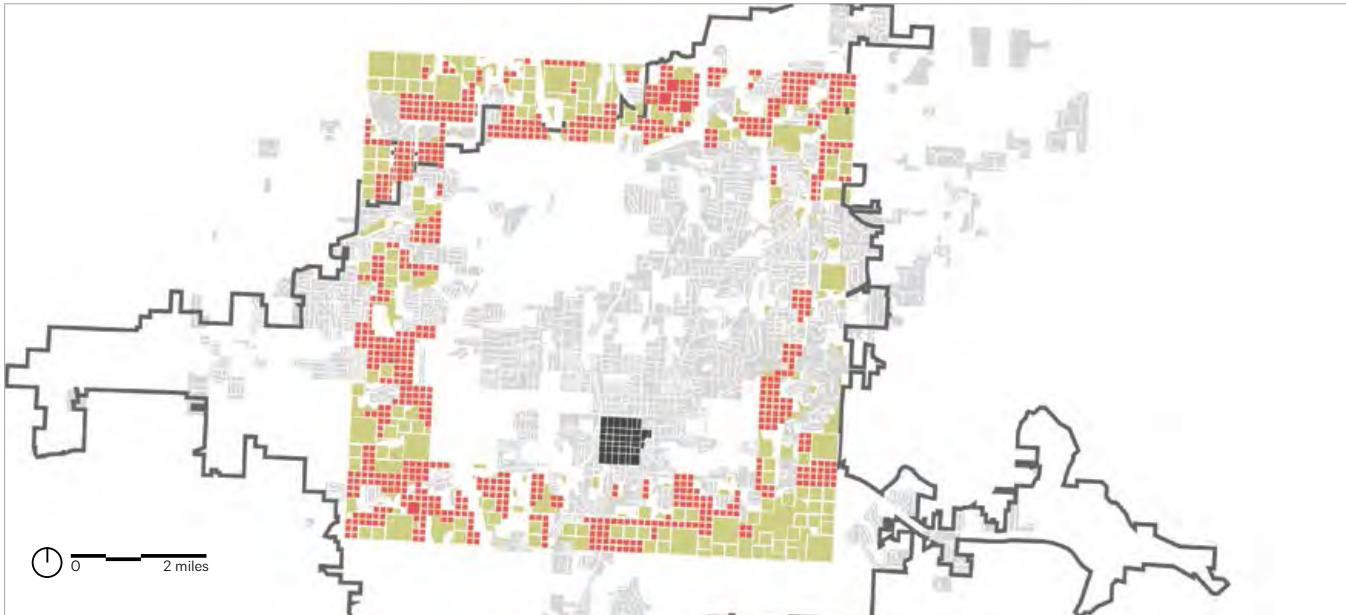


FIGURE 5. Streets

Food City reconstitutes connectivity and walkability in the street network, and resuscitates the area's fledgling bus system through bus rapid transit and transit-oriented development.

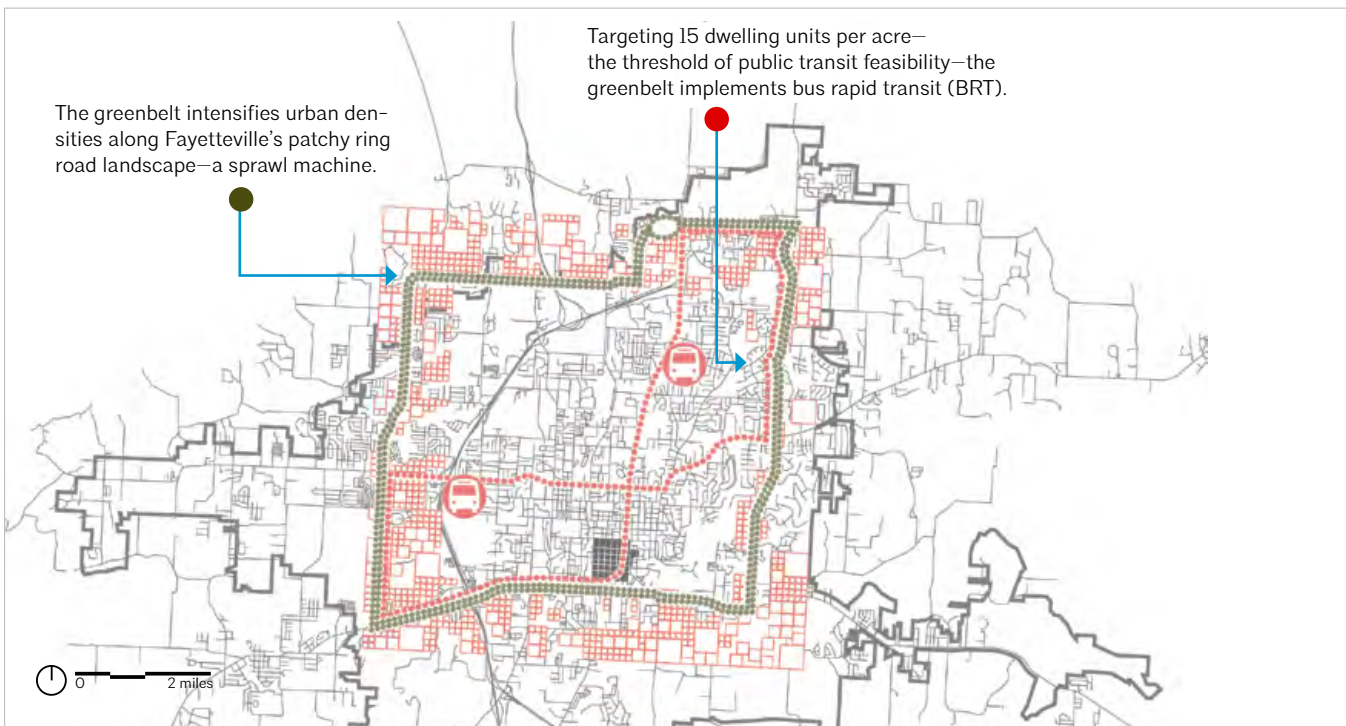
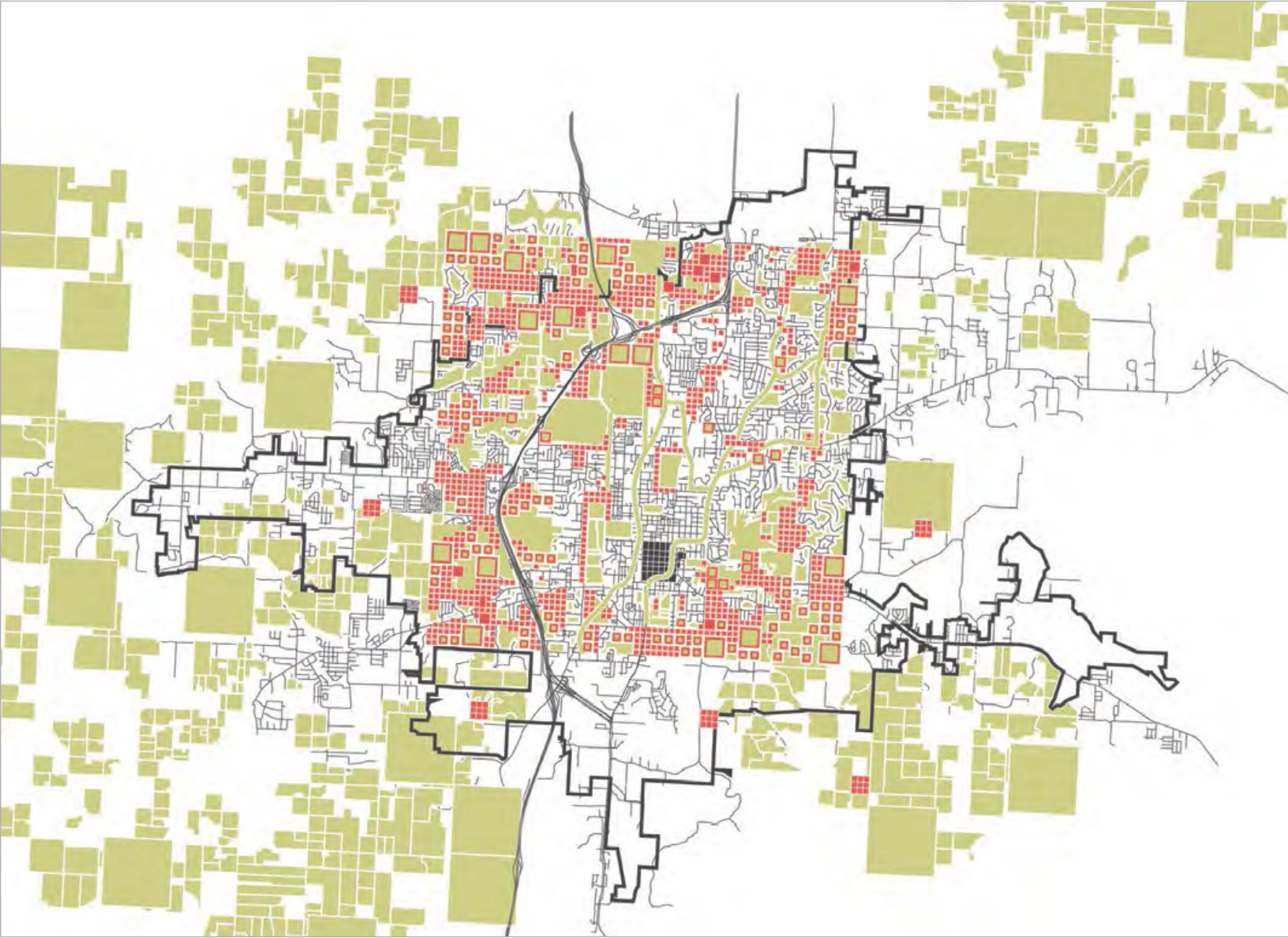


FIGURE 6. 2030 Greenbelt to 2080 MAT Agricultural Urbanism

The urbanized greenbelt would catalyze a successive wave of 2030–2080 growth toward urban core infill resulting in a mat agricultural urbanism. This thoroughly institutionalizes urban food production—an example of successional urbanism evolving recombinant forms of town and country.



Community Assessments and Caloric Budgets

Ecological approaches to agricultural production seek not so much to increase outputs or yields, but to identify and moderate production processes that are optimal—intensive (high-yield inputs related to oil, chemicals, water, and genetic modification, etc.) vs. extensive (sustainable). In their *Preliminary Assessment of Fayetteville Food Security Measures*, ecological engineers defined two important parameters in examining Fayetteville's capacity to support local food production.

First, according to the Food and Agriculture Organization of the United Nations, per capita food demand in an industrialized nation will be 3500 calories per day in 2030 with 30 percent of the demand for animal products and the remaining 70 percent for plant products. While diet profiles vary culturally, human sustenance requires 25 percent calories from fat, 25 percent calories from protein, and 50 percent calories from carbohydrates. To meet this caloric demand Fayetteville will require 172 billion calories per year, entailing substantial amendments to its rocky soil structure. Most local soils lack robust nutrient compositions to support crop diversity, a primary benchmark of resiliency. *Food City*, therefore, proposes comprehensive nutrient upcycling at the municipal scale to recover organic nutrients lost or exported in open-loop systems (e.g., waste treatment, soil erosion, groundwater management, food export, etc.). Design solutions address municipal-scaled nutrient management issues through composting networks, integrated waste management utilities, deep litter farming, and aquaculture toward building healthy productive soils, which takes years.

Second, Fayetteville's existing land area is 35,000 acres. An additional 162,190 acres or 1.25 acres per person would be needed to support beef production based on contemporary diets, which significantly skews the land requirements. Again, not all food production can be urbanized. If beef was removed from the equation and nutritional requirements were met through sources of protein other than beef, then a foodshed of 35,150

acres or 0.25 acres per person would be needed. If this diet were adopted, the urban agricultural framework necessary to support the scenario would be equal to the existing footprint of the city. For planning purposes, *Food City* assumes the latter scenario.

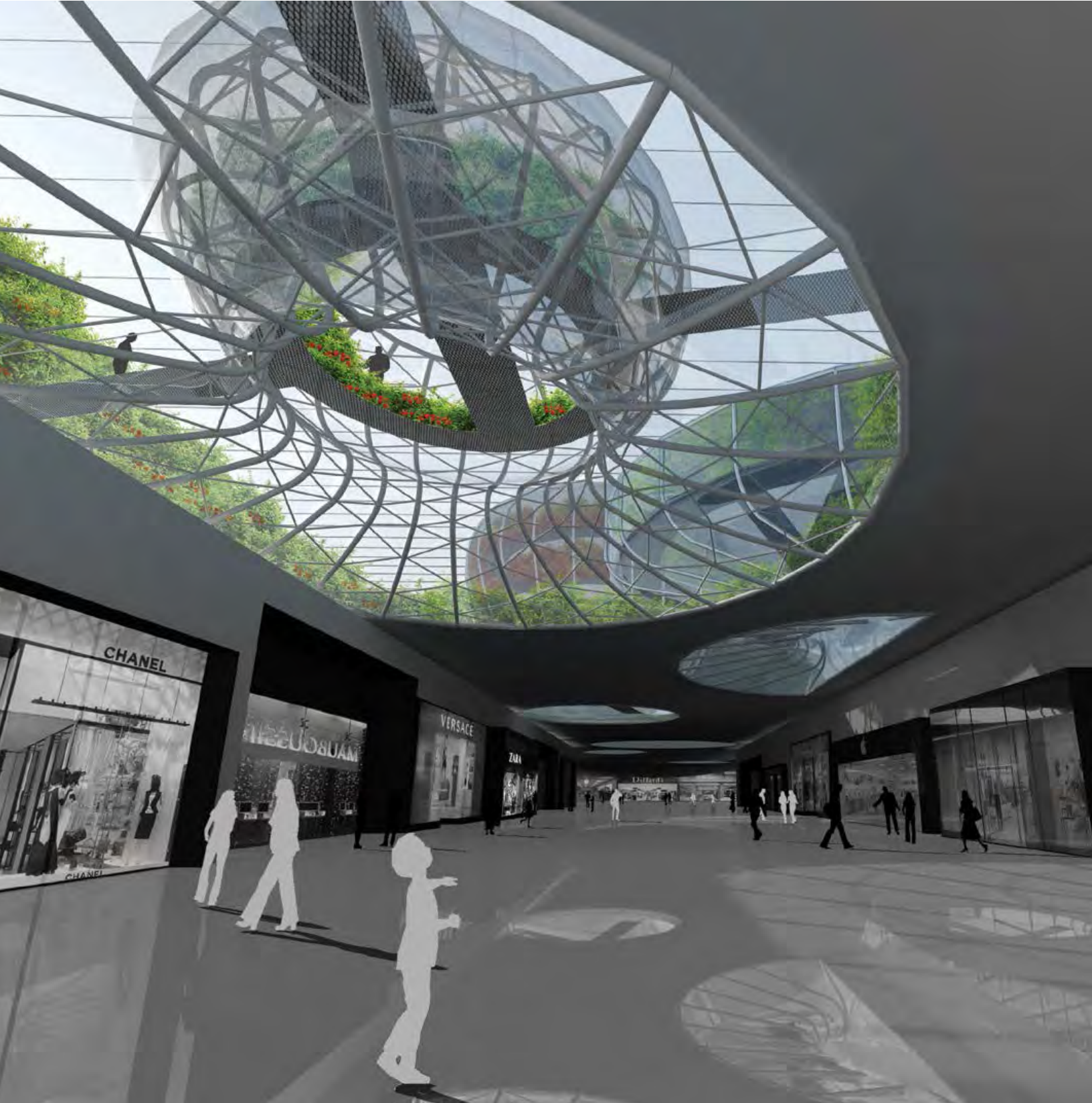
In addition to serving on the city's Local Food Code Task Force, the project team works with local nonprofits like FEED Fayetteville and the Fayetteville Forward Local Food Action Group to formulate best practices, policies, and municipal codes in support of institutionalizing local food production within the city's land use and economic development framework. *Food City* is another tool in the local effort to galvanize nonprofit, government, and market alliances in addressing a significant misalignment between food production and broad-based consumer access.

Conclusion: The Option of Food Production

Food City doesn't demand that everyone become a farmer. Rather, the intent is to recall relationships and patterns expunged from the modern city that are necessary to once again accommodate the option of local food production. Food production constitutes a local economy and a local ecology, requiring a land use system that reconciles urban and landscape systems. In addition to growing strategies, sustainable food production entails upcycling strategies in energy harvesting and nutrient management, a portfolio of water, soil, and conservation strategies, and hybrid forms of human settlement arrangements that blend productive landscape systems and urbanism.

The Five Urban Growing Guilds and agricultural urban real estate products constitute a transferable vocabulary for embedding agricultural capacity into settlement patterns at all scales. Even if significant food production were to fail to appear within Fayetteville's anticipated growth, collateral benefits would still be realized through *Food City's* greater densities, urban lifestyle options, improved ecosystem functioning, and a coherent open

FIGURE 7: Retrofit of existing mall with new rooftop greenhouse



space system that readily accommodates future agricultural development—essentially smart growth. The open space system is integrated with public right-of-ways to accommodate passive and active recreation, strategic land banking, and stormwater management along with fulfillment of other essential ecosystems services.

But the option of agricultural urbanism contributes to healthy cities beyond the role of food production. Farming that negotiates urban dynamics successfully will provide solutions for building healthy soils, delivering ecosystem services, ensuring watershed preservation, and assisting in pollution mitigation—or nutrient management, since pollution is simply the excess of an

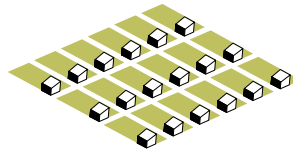
output. Sustainable farming through nutrient upcycling and composting is an excellent pathway to solve for imbalances in urban metabolism and its associated problems in waste management. Agricultural urbanism real estate products also infuse the contemporary city with third places, elevating the social capital of place and the city’s livability. In the course of growth, *Food City* mines the city’s existing footprint to provide for a population doubling in its future. Most importantly, *Food City* provides a framework for building prosperous and resilient communities in an area where a significant portion of the population experiences compounding distress brought by swings in the economy.

“Even if significant food production were to fail to appear within Fayetteville’s anticipated growth, collateral benefits would still be realized through *Food City*’s greater densities, urban lifestyle options, improved ecosystem functioning, and a coherent open space system that readily accommodates future agricultural development—essentially smart growth.”

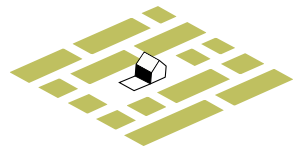
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THE TWENTY-TWO AGRICULTURAL URBAN REAL ESTATE PRODUCTS

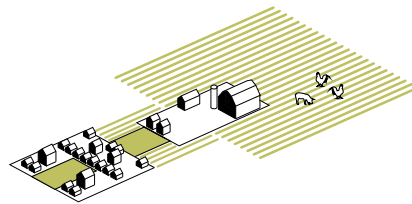
Agricultural urban real estate products are the building blocks for evolving greater complexity in place making. *Food City* adds these hybrid alternatives to the nineteen standard real estate product types constituting mainstream land development (see Christopher Leinberger's list in his *The Option of Urbanism: Investing in a New American Dream*). Financialized by Wall Street through REITs, these stand-alone product types, like build-to-suit-offices, apartments, subdivision housing, big box retail, storage facilities, multi-tenant bulk warehouse, medical offices, motels, etc., have been easy to finance, permit, and trade. But they have mostly produced sprawl. While *Food City* recovers urbanism and the advantages that attend the city, agricultural urbanism real estate products will have to demonstrate consumer appeal and financial worthiness. One point of marketability is *Food City's* reclamation of walkability in neighborhood design, the first step in facilitating greater physical and social activity toward improved general health. Because not all of their benefits can be monetized, agricultural urbanism real estate products' ultimate contributions will be value-added to conventional real estate products.



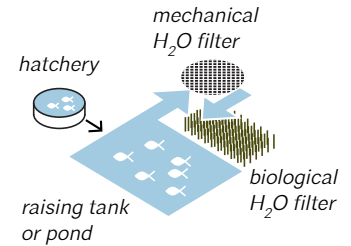
1. ALLOTMENT GARDEN Often a permanent garden subdivided into parcels for individual non-commercial gardening. Each plot is leased from an owner, carries a dues obligation to an allotment association, and usually includes a shed for tools.



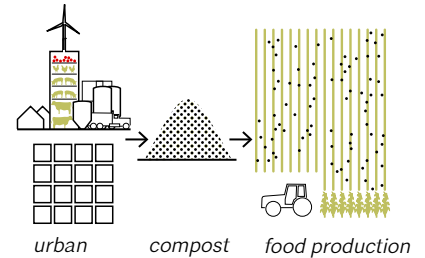
3. COMMUNITY GARDEN Contrary to allotment gardens, this non-commercial garden space is open access and tended collectively by participating gardeners. They can be temporary spaces without formal lease or ownership agreements, as well as be held in trust by local governments or nonprofits.



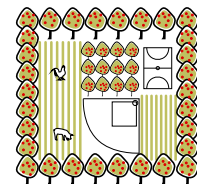
5. DEVELOPMENT-SUPPORTED AGRICULTURE (DSA) A residential real estate development that incorporates preservation or incubation of agricultural land use as its primary organizing structure. DSAs often benefit residents by providing opportunities to participate in small-scale farming.



2. AQUACULTURE FACILITY Complex for the farming of aquatic organisms, including fish, crustaceans, mollusks, and plants in closed loop systems, as opposed to the harvesting of wild fish or plants. **Aquaponics** is the integration of fish farming and plant farming in common beds.

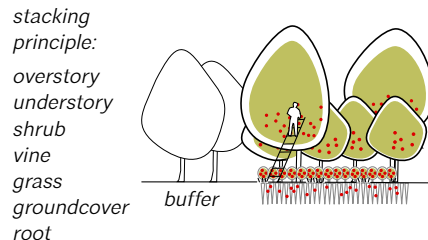
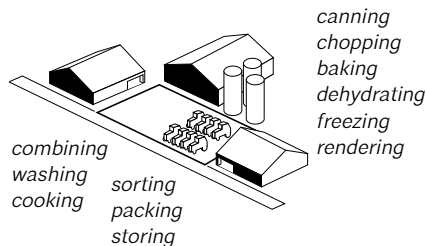
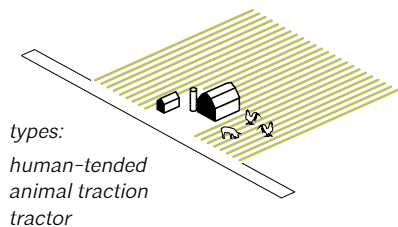


4. COMPOSTING NETWORK Nutrient management of organic waste mixtures through the collection, sequester, and upcycling of decomposed matter into fertilizer for agricultural production. A sustainable alternative to synthetic fertilizers, composting networks divert waste from landfills, remediate contaminated soil, improve soil health and structure, and recover essential macronutrients.



from ornamental to edible landscape

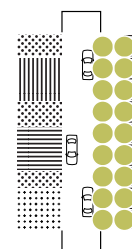
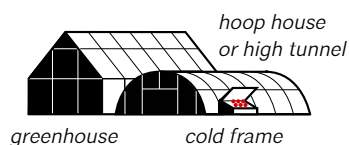
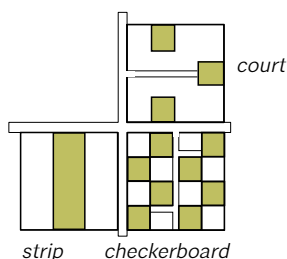
6. EDIBLE PARK Public landscape with mixed uses, including food production which privileges the growing of edible plant communities for harvesting or foraging over ornamental plants.



7. FARM Area of land, body of water, or structure devoted primarily to commercial food production (produce, grain, and livestock), fiber, or fuel. The USDA defines a farm as any place from which \$1,000 or more of agricultural products are produced and sold annually. A **deep litter farm** operates by a waste management system that repeatedly stacks animal stall bedding throughout one season to form manure compost packs as field fertilizer for the following season.

8. FOOD HUB The rise of middle scale farming entails new facilities that aggregate food for collection, processing, and distribution. This includes supplies for agricultural production including machinery, fuel, seeds, and fertilizers alongside public education functions.

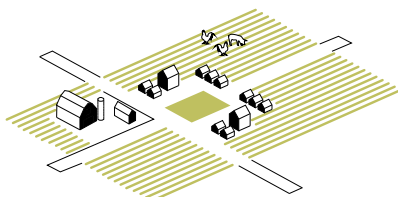
9. FOREST GARDEN Seven-layer polyculture food production hosted in woodland ecosystems, intermixing fruit and nut trees, herbs, vines, shrubs, fungi, and perennial vegetables. The forest garden integrates an interventionist approach, like companion planting and intercropping production techniques, with a woodland conservation approach, constituting an agroecosystem where ecological succession is inflected by human beings.



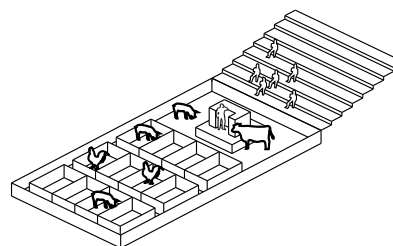
10. GARDEN BLOCK An urban residential block scaled and organized to include shared growing space for food and/or material production within the block's interior. Block interiors accommodate functions for composting, waste management, utilities, play, and parking.

11. GREENHOUSE Transparent or translucent structure in which plants are grown, the smallest type being the miniature **cold frame**. **Hoop houses** are becoming common for animal husbandry. Greenhouses trap and retain solar radiation, creating a heated environment through convection. Their controlled environments allow growers to overcome obstacles related to climate, seasonality, pest management and hours of daylight.

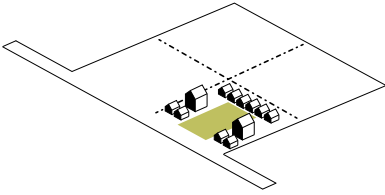
12. GROW STREET (GARDENED RIGHT-OF-WAY) Public right-of-ways that incorporate food production involving orchard-lined streets, fruit boulevards (e.g., Valencia and Seville), planting strips or tree lawns, and edible front yards.



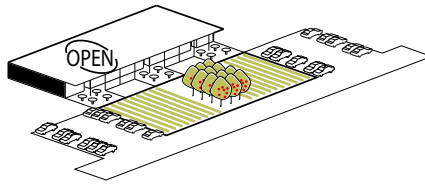
13. HAMLET A form of peri-urban cluster development involving a group of houses and processing facilities arranged around agricultural production or distribution.



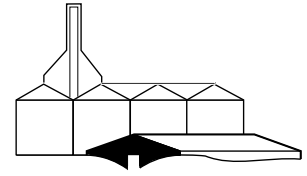
14. LIVESTOCK EXCHANGE/ARENA relocalization of food production involves revitalization of local wholesale markets, including the livestock exchange, where services related to animal trade, valuations, breeding, and processing are offered.



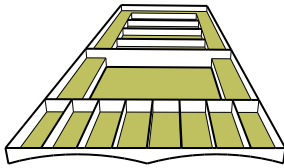
15. POCKET NEIGHBORHOOD
A cluster of 4–16 homes centered around a commons and other shared landscapes, including parking and growing spaces, which typically fits within a city block fabric.



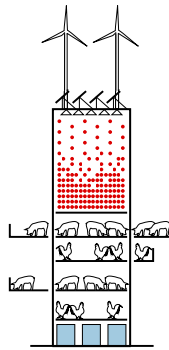
16. RESTAURANT FARM Farm-to-table compact where a farm, usually an artisanal operation, dedicates its product to locavore eateries. The farm and restaurant do not have to be at the same location.



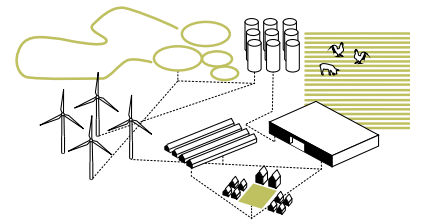
17. STORAGE Food production for resiliency requires community-scaled storage including cold storage, silos, and cellars.



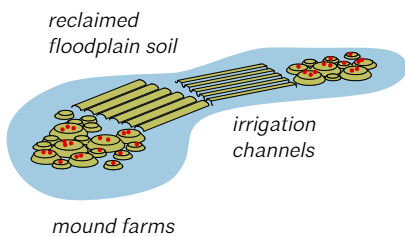
18. THERMAL GARDEN WALL System of masonry or concrete walls deployed as heat sinks in gardens to trap and retain solar radiation. Thermal walls create a heated sunken microclimate that extends the growing season in temperate climates and hosts plant growth in vertical formats.



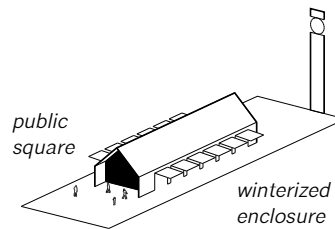
19. VERTICAL FARM High-yield farming in low-to-high rise buildings where the guiding criteria may include insulation from weather, pest management, recycling of concentrated waste streams, high land costs, and controlled use of artificial light, water, and other growing inputs.



20. WASTE-TO-ENERGY DISTRICT
Form of energy recovery among symbiotic operations in which waste streams from contributing operations are redirected as energy inputs for recipient operations. While the more common WtE technology involves incineration, less capital-intensive applications using non-thermal technologies (i.e., anaerobic digestion, fermentation, and mechanical biological treatment) are more applicable in agricultural urbanism.



21. WETLAND FARMING Polyculture food production involving annual and perennial plants hosted in wetland landscapes, mostly intermixing berries, nuts, grains, seeds, and tubers. A type of agroecosystem, wetland gardens attract fowl and aquatic wildlife in addition to plant based food production.



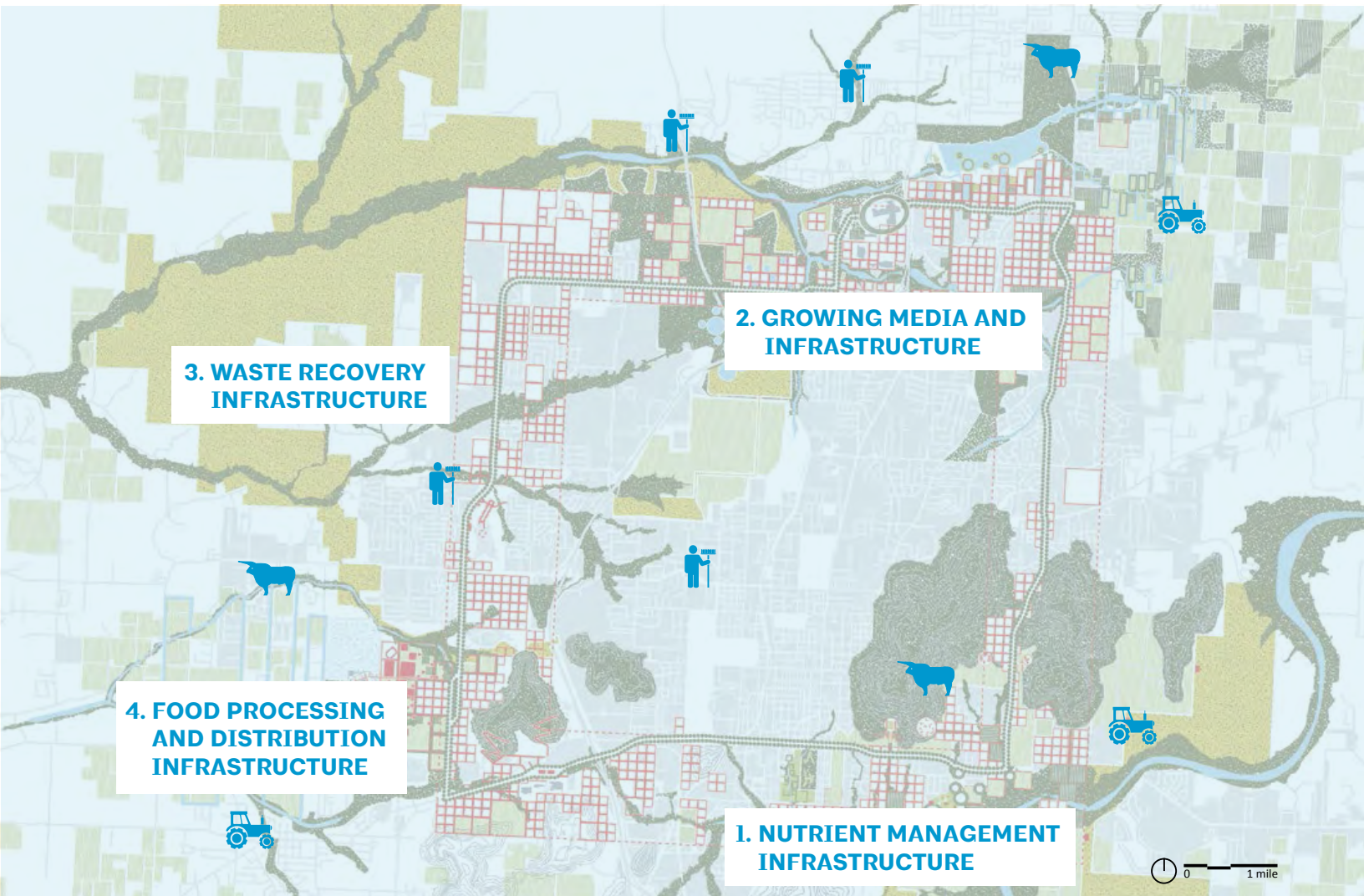
22. WINTER FARMERS MARKET
Permanent facility in cold to temperate climates that houses producer-to-consumer food purchases year round beyond the summer months.

FIGURE 8. GROW Street



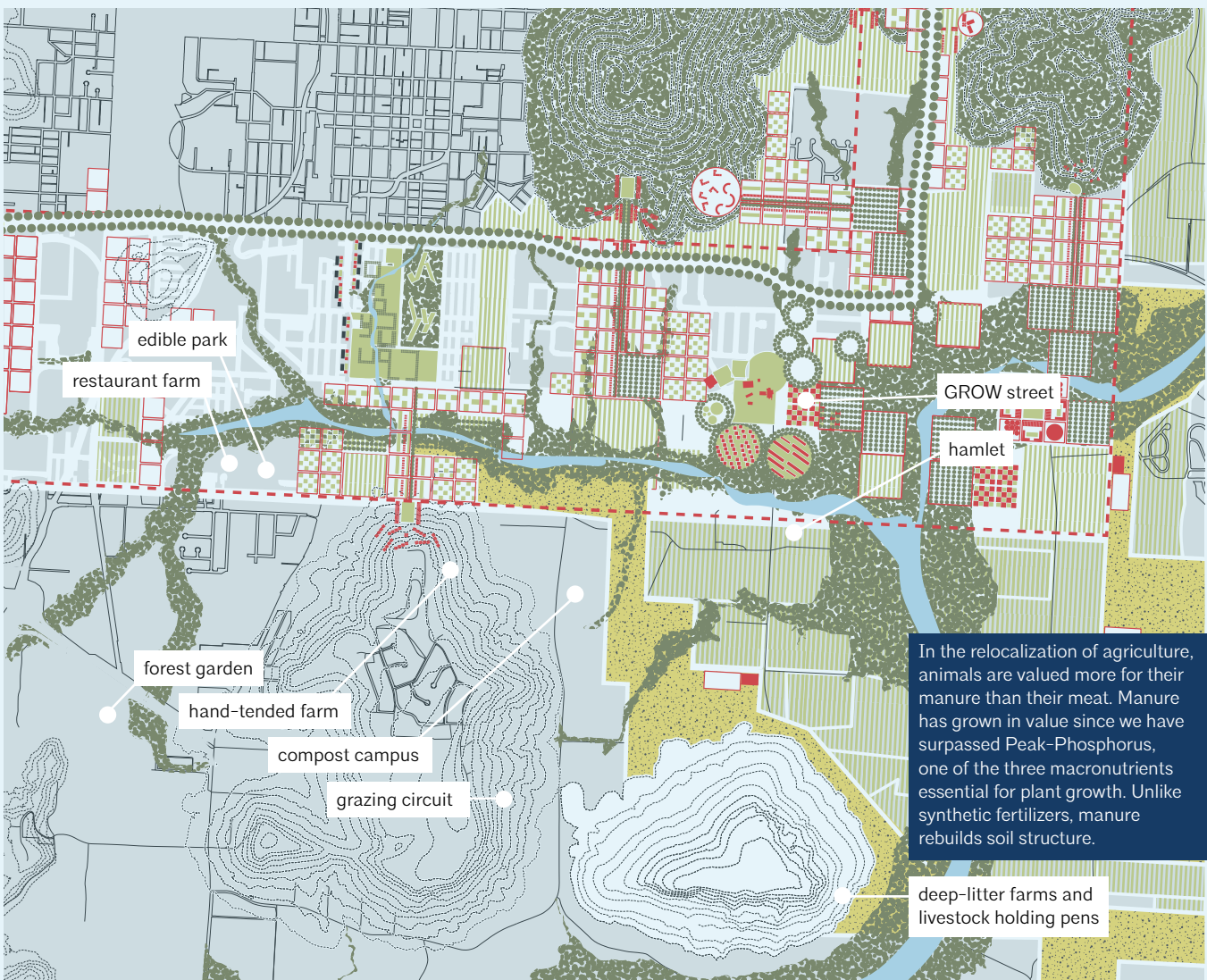
Infrastructure Proposals

human-tended farm  tractor farm  animal-traction farm 



“...the next green revolution may come from optimizing the soil.”—William McDonough & Michael Braungart, *The Upcycle: Beyond Sustainability—Designing for Abundance*

I Nutrient Management Infrastructure



0 .25 .5 1 mile

COMPOST CAMPUS These territories are structured around citywide resource recovery and upcycling to reclaim essential biological macronutrients—phosphorous, nitrogen, and potassium—from waste. Nutrient management of organic material in foodstuffs, plant biomass, yard clippings, and manure (from surrounding deep litter farms) involves composting and rebroadcast across neighboring farms and gardens to rebuild community soil structure. Composting eliminates the need for synthetic fertilizers, which destroy topsoil, leach essential nutrients, and reduce absorptive capacity and drought tolerance. Production of synthetic fertilizers and pesticides consume a third of total energy usage in the agricultural sector.

- 1 White River
- 2 composting facility
- 3 anaerobic and aerobic composting
- 4 vermicomposting (worm-based)
- 5 stormwater management
- 6 food forest
- 7 residential garden block
- 8 hand-tended farm
- 9 tractor farm
- 10 deep litter farm
- 11 GROW street

windbreaks provide wildlife refugia and soil protection from wind erosion.

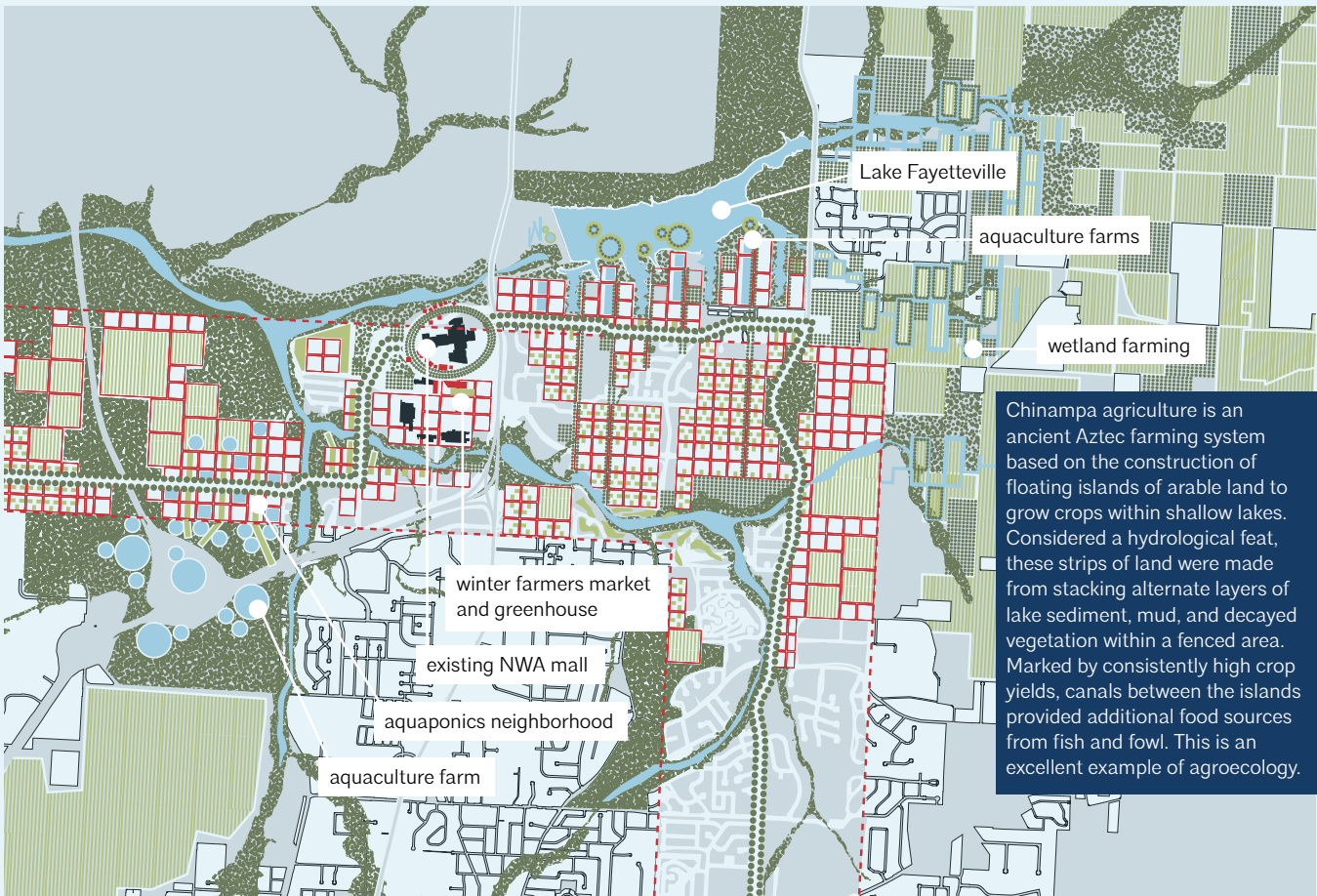
shelterbelts provide refuge for livestock, control odors, and can be productive landscapes.

pollutant remediation guild uses plants that can control odors and treat stormwater or remove airborne particulates



2 Growing Media and Infrastructure

“In traditional soil farming, the key limiting factor is the active transportation of nutrients to the roots. Freshwater aquatic systems are ideal media for vegetation.”—William McDonough & Michael Braungart, *The Upcycle: Beyond Sustainability—Designing for Abundance*



LAKE NEIGHBORHOOD: INTEGRATED POND SYSTEMS

The infrastructure for sustainable aquaponics doubles as a development amenity for neighborhoods. Aquaponics harnesses the lake ecology, including cultivation of wetland landscape guilds, to address one of the biggest problems associated with aquaculture: management of fish waste. Infrastructure includes hatcheries, growing ponds, net pens, cages, boardwalks, roosting towers, water towers, floating filters and beds, and wetlands, which constitutes a unique urban open space system.

- 1 grow-out pond
- 2 wetlands
- 3 suspended pond
- 4 water tower
- 5 aquaponics
- 6 bird rookery
- 7 floating gardens
- 8 hatchery
- 9 nursing pond
- 10 residential garden block
- 11 nut boulevard
- 12 pocket neighborhoods

extensive pond aquaponics

intensive pond aquaponics

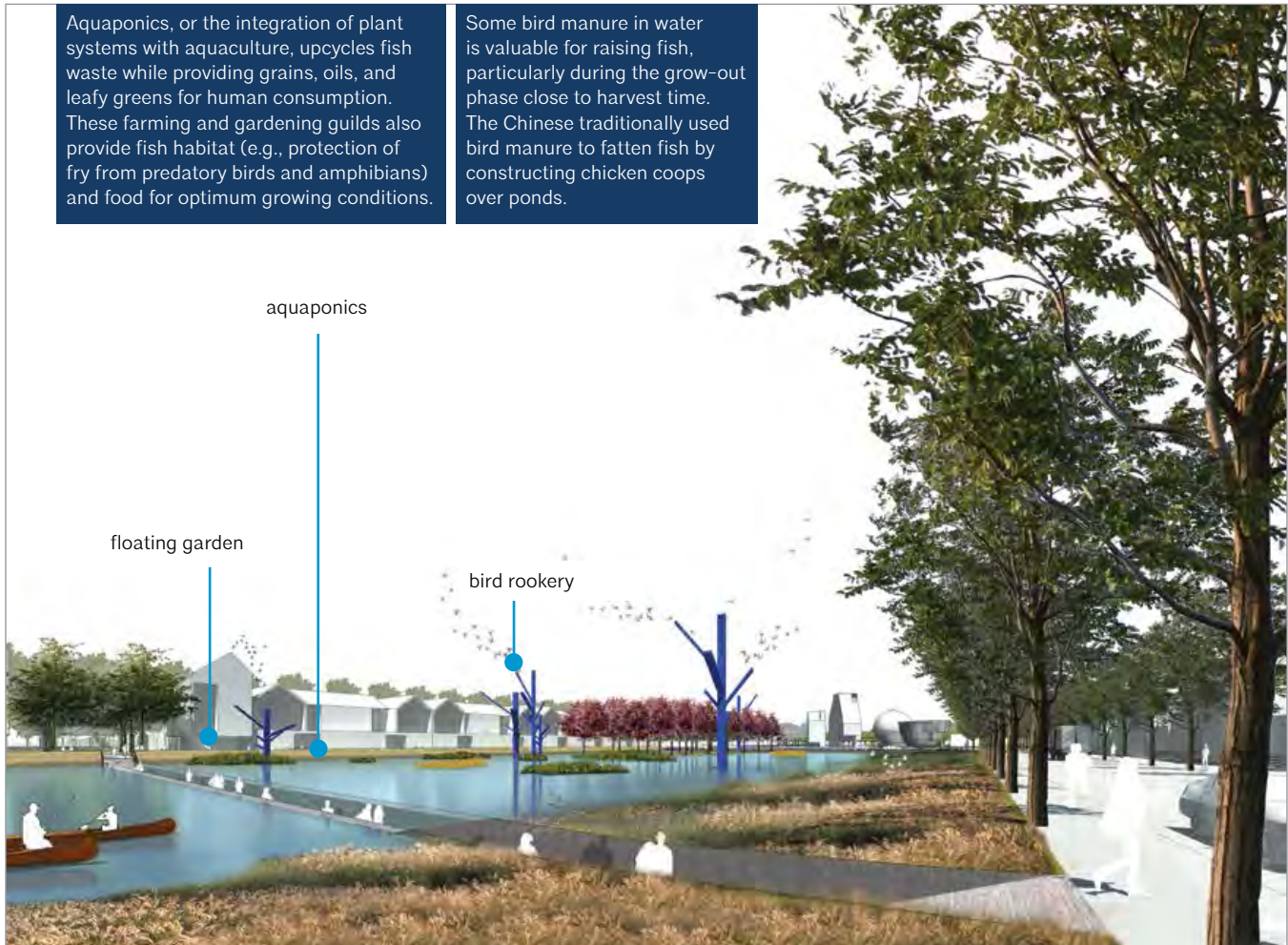
foraging pond



PONDS AS THE NEW COMMONS Aquaculture technologies range from intensive to extensive, the latter being integrated pond systems among urban or agricultural land uses. The phases of aquaculture include broodstock holding, hatchery, nursing, grow-out, and quarantining (for acclimation and disease control). While much research is still needed to determine the scalability of systems and fit within urban land uses, as well as an understanding of fish social structures, ponds can be the new commons. But they must be built, as lakes and ponds are not native to Northwest Arkansas (Lake Fayetteville is a reservoir). The ecology of the pond and attending wetlands are developed over time with the participation of urban residents—development of landscape and wildlife biodiversity, provision of habitat, harvesting, and nutrient management through feeding food wastes to fish and submerging used Christmas trees under water.

Aquaponics, or the integration of plant systems with aquaculture, upcycles fish waste while providing grains, oils, and leafy greens for human consumption. These farming and gardening guilds also provide fish habitat (e.g., protection of fry from predatory birds and amphibians) and food for optimum growing conditions.

Some bird manure in water is valuable for raising fish, particularly during the grow-out phase close to harvest time. The Chinese traditionally used bird manure to fatten fish by constructing chicken coops over ponds.



GROW STREET: MOVING BEYOND THE BACKYARD

The desire and ability to produce food is socially transmitted. Gardened Right-Of-Ways privilege food production and other non-traffic functions within the street yet still accommodate traffic uses. The best GROW Streets will integrate front yards cultivated as food growing systems—“edible estates”—with fruit-bearing right-of-ways to create great community spaces. Pollution remediation landscape guilds featuring bioswales, filter strips, and infiltration basins protect food production spaces from contaminants in stormwater runoff. Special building frontage systems with verandas, modulated garden sheds and screened porches complete this shared space.

Usufruct laws provide the legal right to harvest fruit from private or public property if it overhangs, or is accessible from, public and even semi-public space.

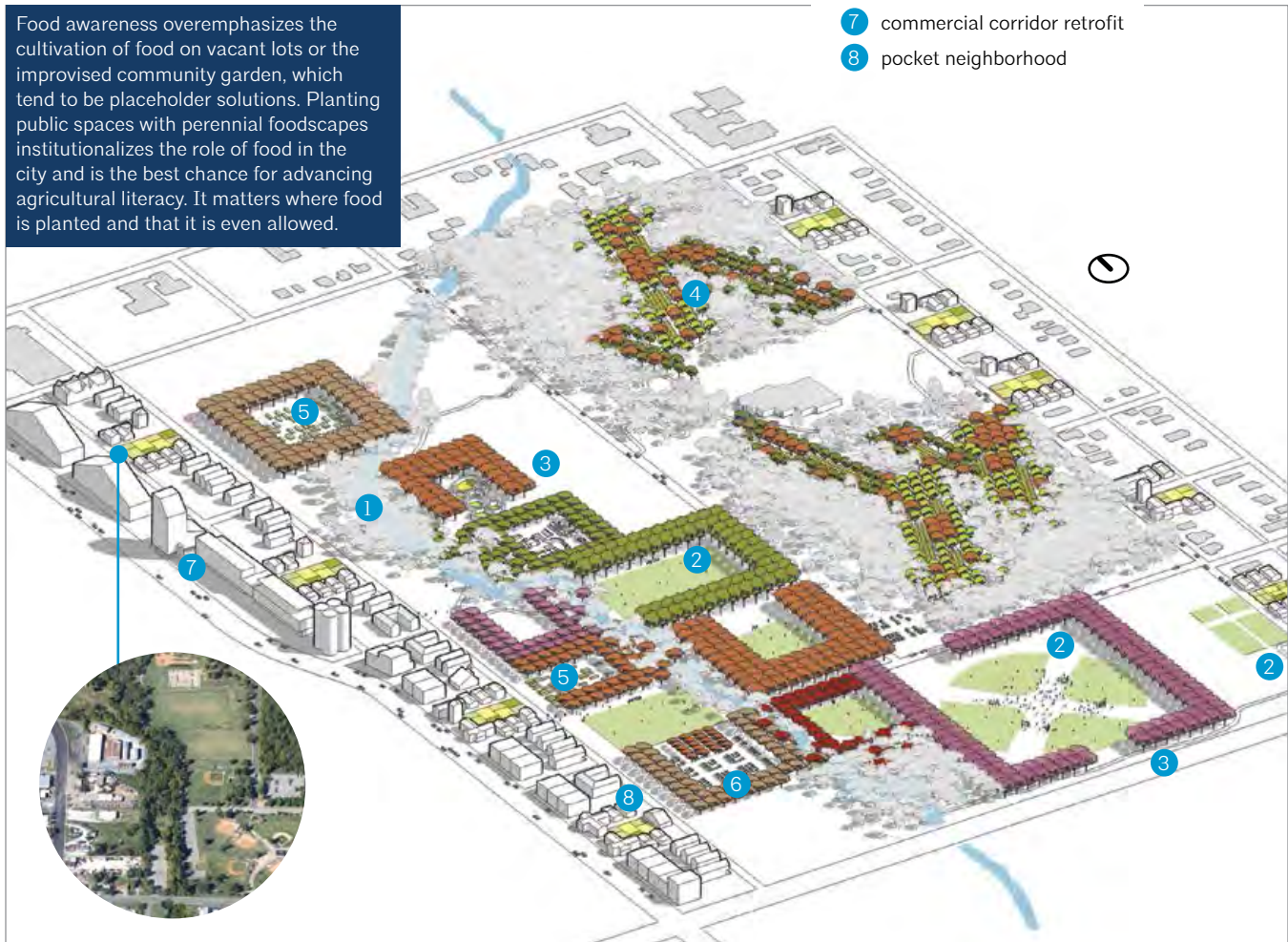


EDIBLE PARK Public facilities, like Walker Park, are ideal places to substitute productive edible landscapes for ornamental landscapes. Nut and soft fruit allees organize recreational functions within public rooms. Foraging by individuals is supplemented with harvesting by civic volunteer groups, while city maintenance staff attends to pruning and pest management.



- 1 existing riparian
- 2 existing sports fields
- 3 nut and fruit allees
- 4 food forest
- 5 community gardens
- 6 parking garden
- 7 commercial corridor retrofit
- 8 pocket neighborhood

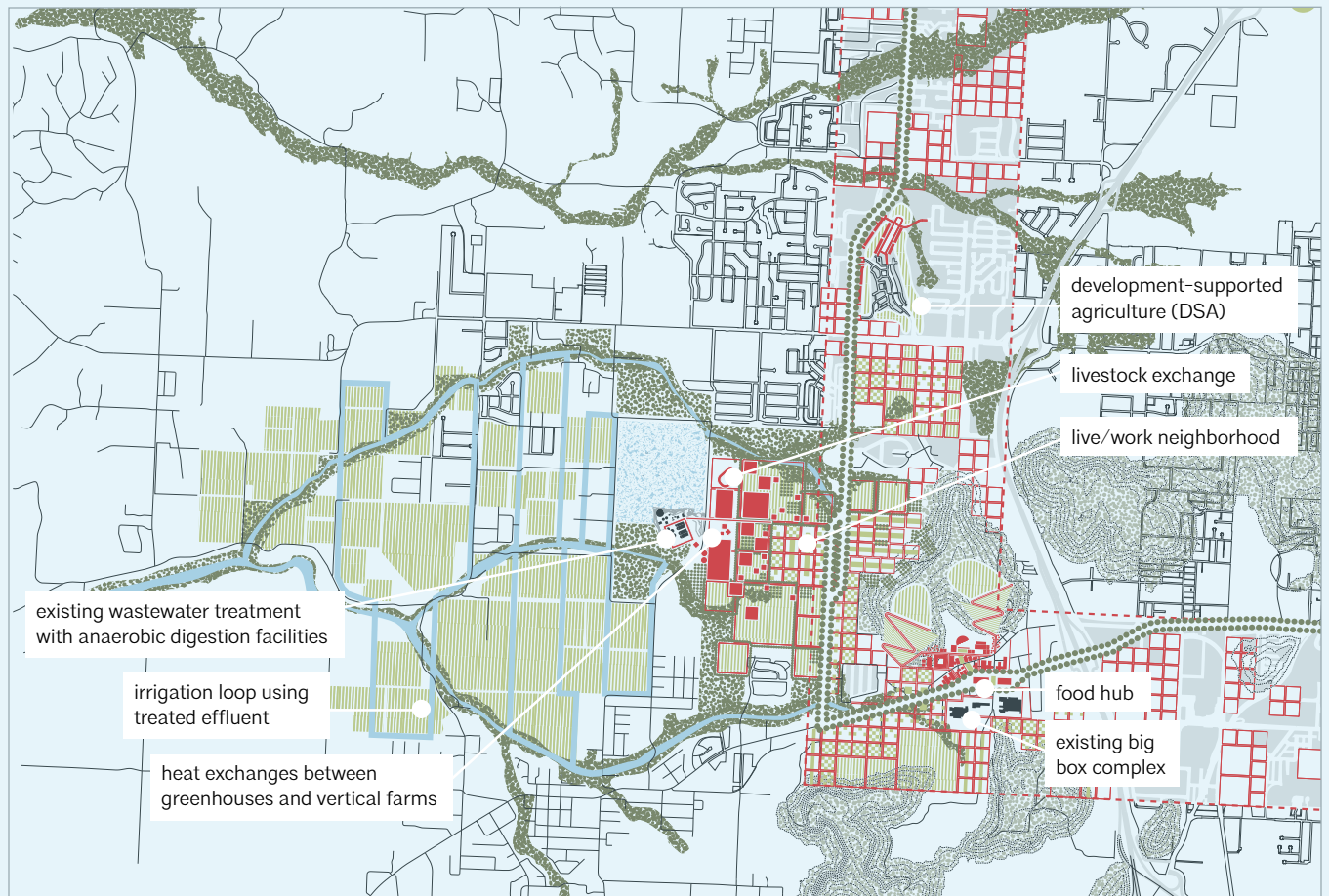
Food awareness overemphasizes the cultivation of food on vacant lots or the improvised community garden, which tend to be placeholder solutions. Planting public spaces with perennial foodscapes institutionalizes the role of food in the city and is the best chance for advancing agricultural literacy. It matters where food is planted and that it is even allowed.



3 Waste Recovery Infrastructure

“The vast majority of our local food systems are not self-reliant or self-sustaining in terms of fertility inputs, much less energy...Resource recovery drives regenerative food systems.”

—Philip Ackerman-Leist, *Rebuilding the Foodshed: How to Create Local, Sustainable, and Secure Food Systems*



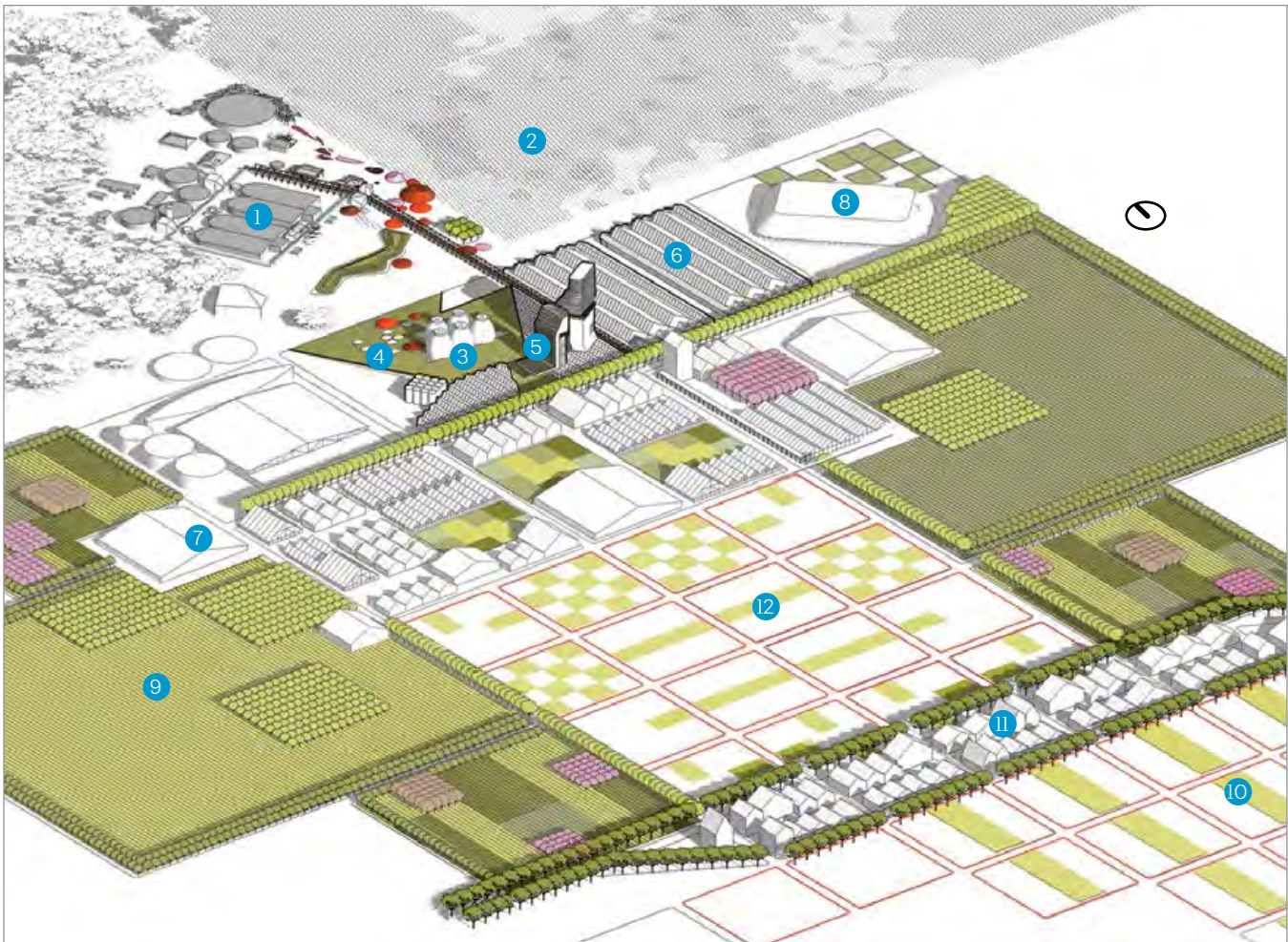
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WASTE-TO-ENERGY FACILITY

Located at the city's Westside Wastewater Treatment Plant, waste recovery facilities sort, reclaim, and upcycle nutrients in waste streams. Biosolids are recovered for fertilizer, methane gas for biodigestion and energy supply, and clean effluent for greenhouse irrigation, hydroponics, and aquaponics. Closing the loop mitigates a problematic resource transfer where municipal water supply drawn from the White River Watershed is discharged as treated effluent to the Illinois River Watershed. Sustainable farming rebalances urban metabolism through nutrient management and the creation of manageable closed loops.

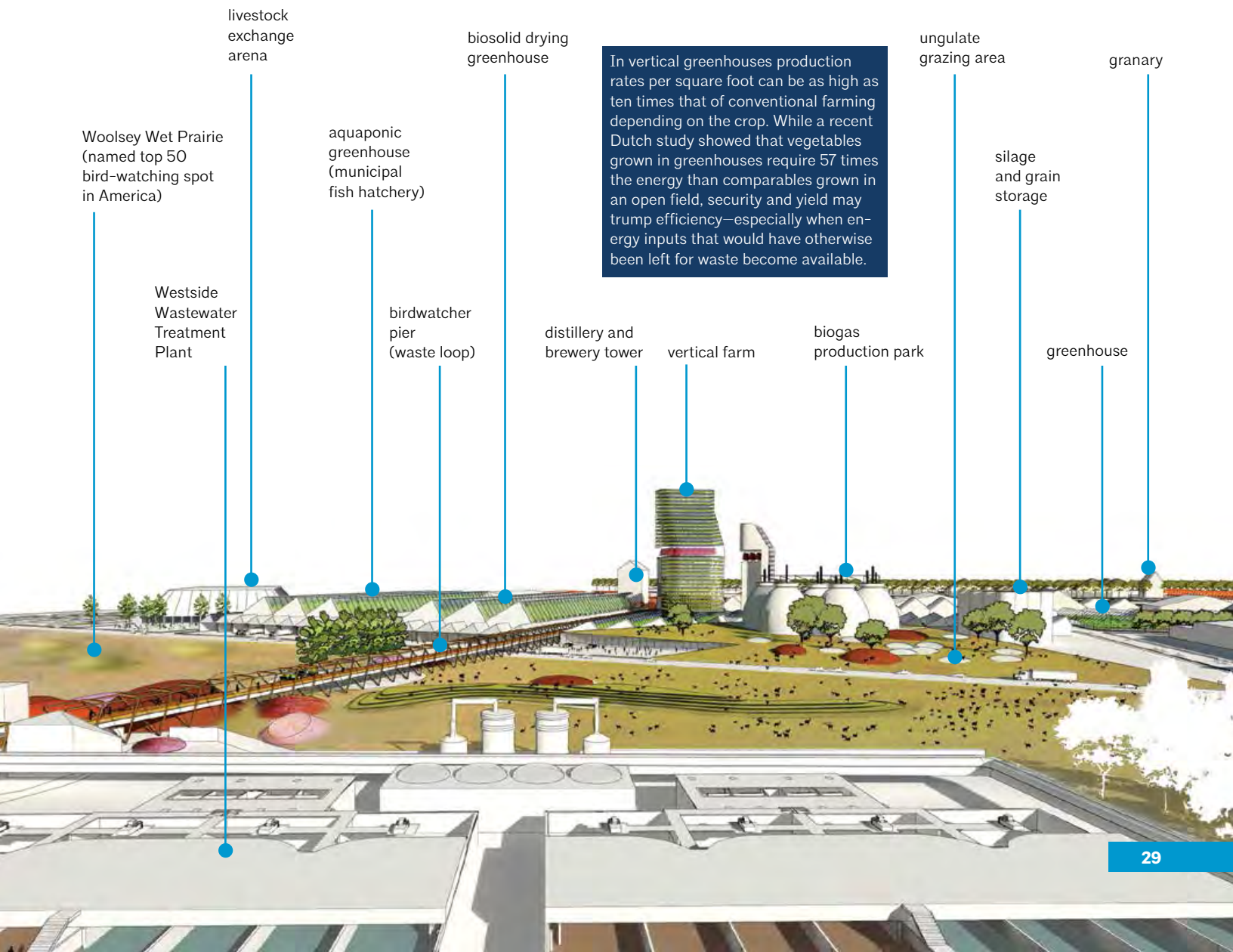


- | | |
|---------------------------------------|--------------------------------------|
| ① existing wastewater treatment plant | ⑦ biosolids storage and distribution |
| ② existing legacy meadow | ⑧ livestock exchange |
| ③ anaerobic digester | ⑨ animal-traction farm |
| ④ cogeneration plant and grazing roof | ⑩ residential garden block |
| ⑤ vertical farm | ⑪ hamlet on nut boulevard |
| ⑥ greenhouse | ⑫ live/work neighborhood |



MICROGENERATION PARK: SOIL-TO-SOIL LOOP

Aggregation of heavy energy users facilitates the small-scale generation of heat and power where inputs and outputs are exchanged and upcycled as a supplement to central grid-connected power. Here, breweries, distilleries, greenhouses and vertical farms for growing plants and animals are combined with the municipal wastewater facility using appropriately-scaled technologies in anaerobic digestion, fermentation, distillation, and mechanical biological treatment. "Appropriate technology" considers efficiency in scale and power intensity of a technology in alignment with an intended outcome for a given location. The goal of cross-programming these land uses is to move toward a zero-waste production ecosystem.



In vertical greenhouses production rates per square foot can be as high as ten times that of conventional farming depending on the crop. While a recent Dutch study showed that vegetables grown in greenhouses require 57 times the energy than comparables grown in an open field, security and yield may trump efficiency—especially when energy inputs that would have otherwise been left for waste become available.

4 Food Processing and Distribution Infrastructure

“The more consumers insist on fresh, local food, the more businesses will spring up to supply local seeds, test soil, package and sell compost, manage temporary land leases, supply local processing, grow indoor greens, develop farm-centered subdivisions, invest in technological innovations—and a lot more.”—Peter Ladner,

The Urban Food Revolution: Changing the Way We Feed Cities

RESTAURANT FARM: POP-UP GARDEN Even strip centers along arterials can be easily transformed to support growing spaces. In this case, two feet of top soil with a straw base is thrown over the parking lot to support a garden, sufficient to sustain a healthy root zone with attendant microbial activity. To extend the growing period, a sunken thermal garden wall system made from cement blocks surrounds hot beds (using thermophilic composting) and supports espaliered plantings heated by walls—an ideal “season stretcher”.

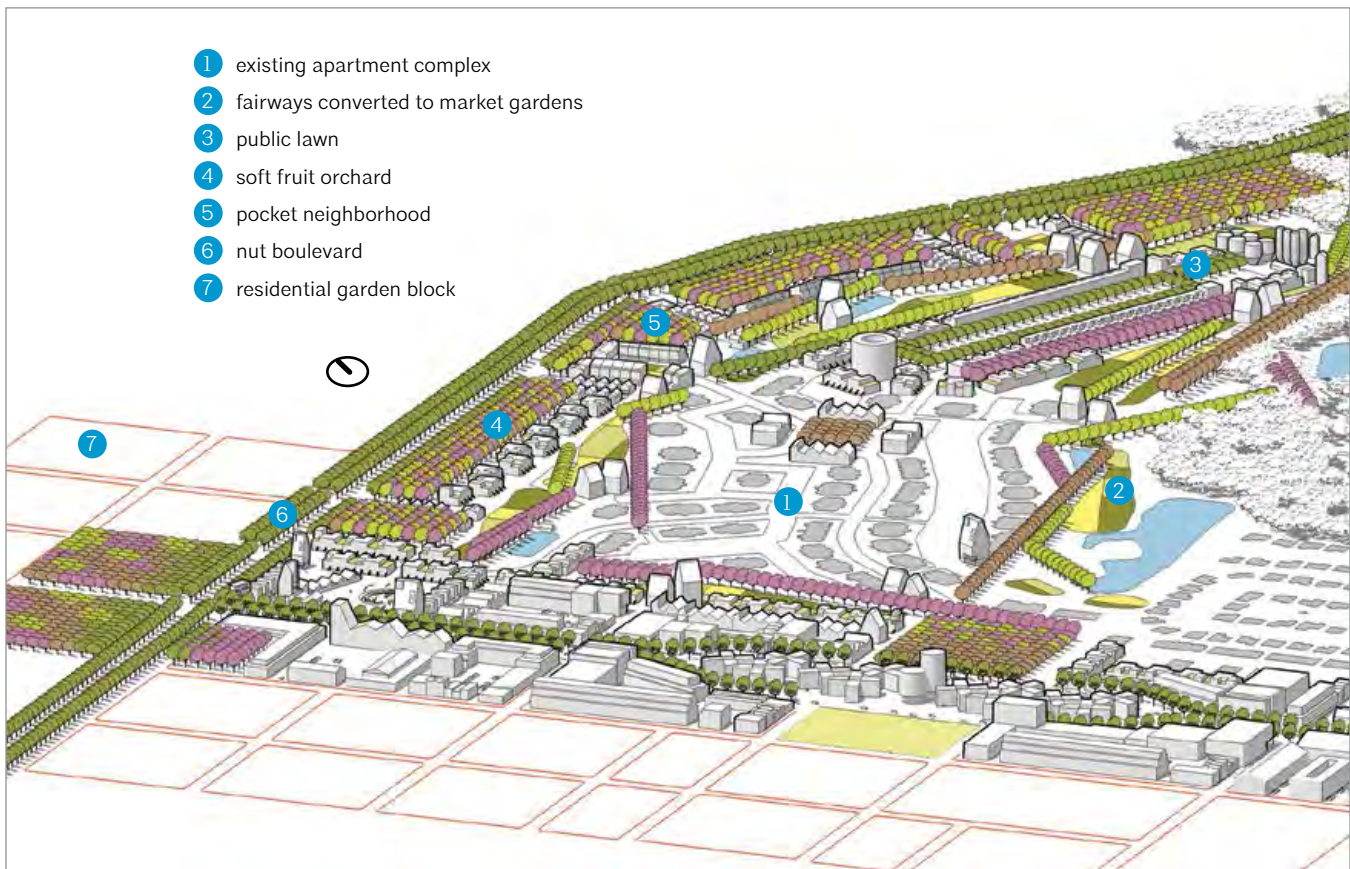


pollutant remediation guild

a thermal wall garden system: provides a series of sunken chambers that create microclimates for growing fruits and vegetables beyond their typical season—season stretcher.

grow beds on existing asphalt

FROM FAIRWAYS TO COMMUNITY GARDENS: DEVELOPMENT SUPPORTED AGRICULTURE A better and higher use of this underutilized suburban golf course is development supported agriculture. Fairways in this nine-hole course are retrofitted to sponsor urban pocket neighborhoods clustered around community growing spaces, or pure farming plots connected by a neighborhood greenway. And, the irrigation is already in place. Farming has become a development amenity.



MALL RETROFIT: GEOTHERMAL

DISTRICT Beginning with Joseph Paxton's Crystal Palace, indoor malls and greenhouses have a shared history. Greenhouses on the mall's roof and edge optimize district-based energy storage and exchange, meanwhile creating a civic landmark at the highest point along this uptown ridge.



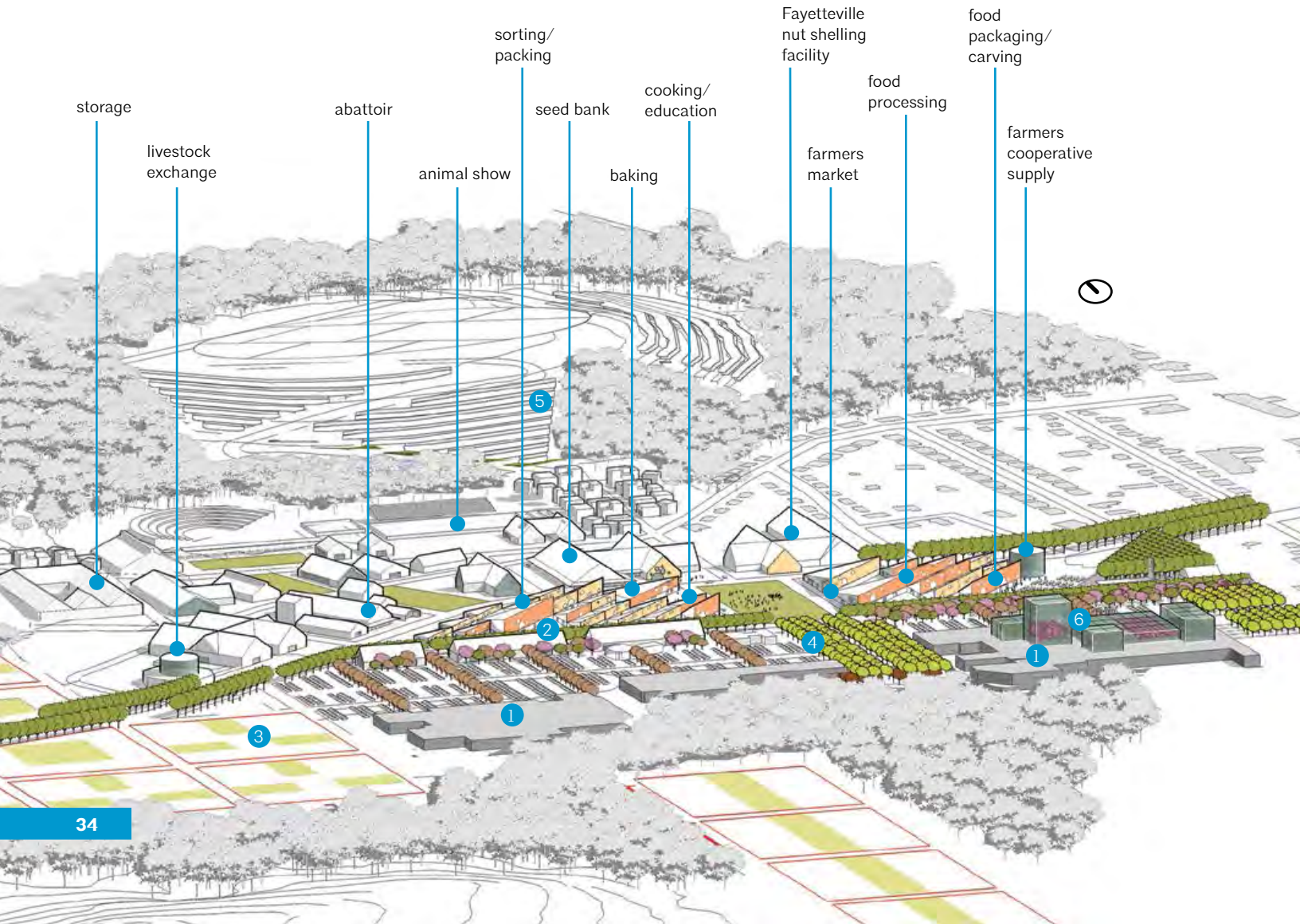
- 1 existing mall
- 2 existing big box stores
- 3 greenhouse roof
- 4 winterized farmers market and greenhouse
- 5 vertical farm and housing
- 6 thermal garden wall
- 7 fruit orchards
- 8 nut boulevard
- 9 residential garden block



FOOD HUB Community-scaled food processing and distribution facilities—like local abattoirs for example—have disappeared with the consolidation of industrial agriculture. Relocalization of a food economy requires a processing infrastructure scaled to the economics of small to mid-size farming. Here, Food City’s hub aggregates facilities for food processing, preparation and packaging, distribution, and marketing at a big box district into town forms.



- 1 existing big box retail center
- 2 food hub
- 3 residential garden block
- 4 fruit orchards
- 5 growing terraces
- 6 greenhouse on big box retail





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