



MICRO-CREDENTIAL

LAND MANAGEMENT IN CENTRAL ASIA

6.- Rational Land Use and Efficiency

Social Efficiency

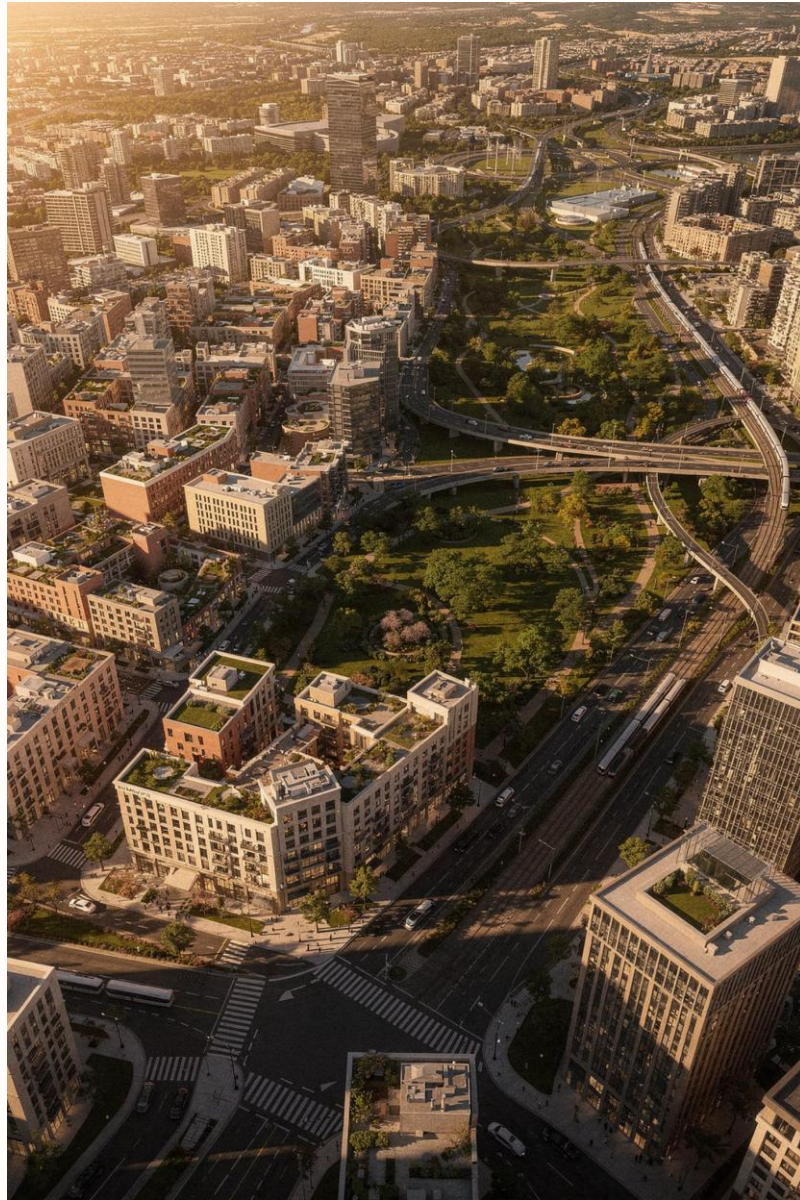
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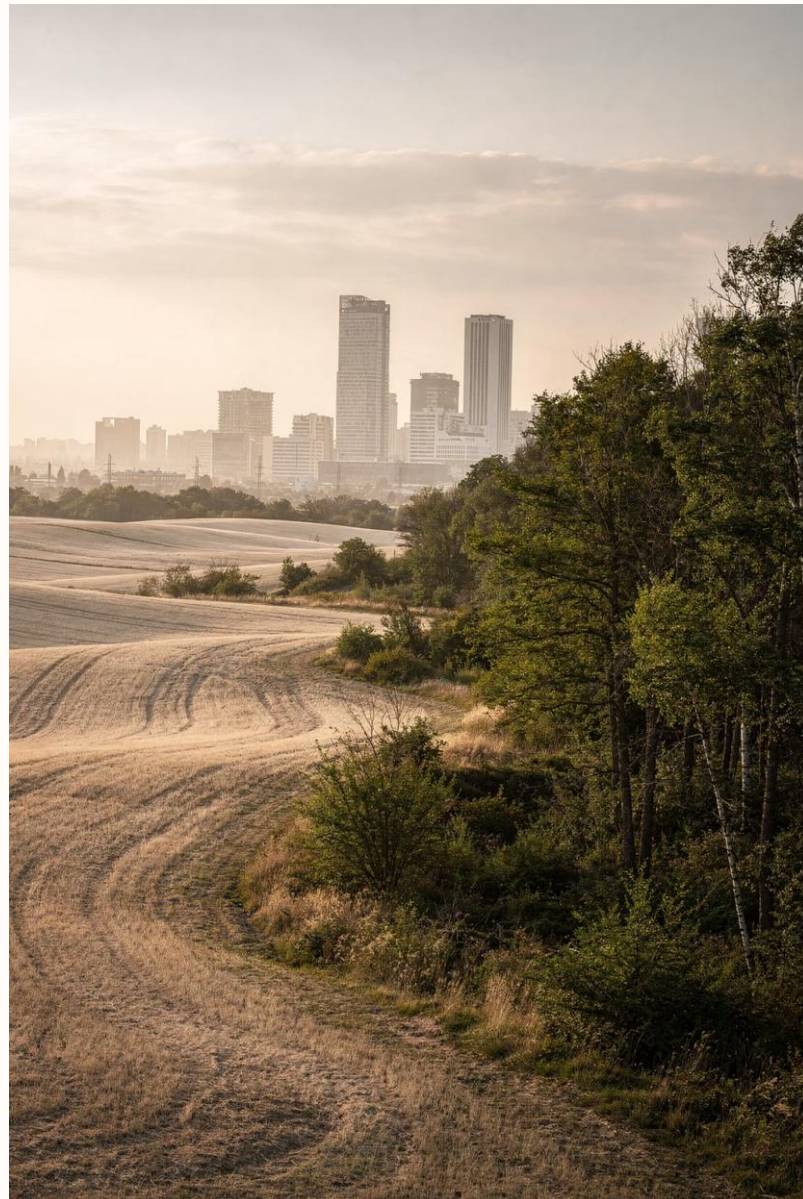
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Social Efficiency: Mastering Land Use for a Better Future



How we allocate, manage, and govern land is one of the most consequential decisions a society can make. From the density of our cities to the sprawl of our suburbs, from the preservation of green corridors to the siting of industry — land use shapes economic productivity, social equity, and environmental resilience for generations to come. This presentation explores the theory and practice of rational land use, drawing on foundational economic models, cutting-edge urban policy research, and the lessons of cities that have succeeded — and failed — to harness their land for the common good.



Before we can optimize land use, we must first understand what makes land uniquely important among all economic resources — and why its management sits at the very heart of social efficiency.

Land is among the most fundamental and irreplaceable resources in any economy. Unlike capital or labor, it cannot be manufactured, imported, or meaningfully substituted — its total supply is fixed, even as the demands placed upon it grow ever more complex and competing. Its use has cascading effects that reach far beyond the parcel itself.

Economic Driver

Land underpins virtually all economic activity — from agriculture and industry to commercial real estate and residential development. The efficiency with which land is allocated determines, in large part, the productivity of an entire regional economy. Misallocated land generates deadweight losses that compound over decades.

Social Infrastructure

Housing, schools, hospitals, parks, and public institutions all compete for finite land. The spatial arrangement of these uses determines who can access opportunity, how long residents commute, and whether communities are cohesive or fragmented. Poor land use planning consistently reproduces social inequality across generations.

The Dual Pillars: Efficiency and Equity

At the heart of any serious land use framework lies a fundamental tension between two indispensable values. Getting either one wrong — or sacrificing one entirely at the altar of the other — produces outcomes that fail society in important ways. The most sophisticated land policy frameworks treat efficiency and equity not as opposites, but as complementary goals that must be actively balanced through careful design.

Efficiency

Efficiency in land use means extracting the maximum possible economic and social value from every parcel. This involves directing land toward its highest-value productive uses, minimizing waste through compact development, reducing unnecessary travel distances, and ensuring that infrastructure investment is matched by appropriate density. Economically efficient land markets tend to produce higher aggregate output, lower costs of living, and greater innovation through agglomeration effects.

- Aligning land use with its highest-value application
- Reducing infrastructure waste from sprawl and under-use
- Capturing agglomeration spillovers through density
- Minimizing externalities that distort market outcomes

- Fair access to well-located housing and services
- Preventing displacement of vulnerable communities
- Redistributing land value gains to the public
- Inclusive planning processes and governance

Equity demands that the benefits of well-located, productive land are accessible to all members of society — not merely those with the greatest purchasing power. Historically, land markets have concentrated wealth and opportunity among landowners while displacing lower-income residents from areas of high amenity. Equitable land policy intervenes to ensure that public infrastructure investment, zoning decisions, and development rights are distributed in ways that broaden access and reduce spatial inequality.

The intellectual tradition of designing cities for maximum welfare is older than it might appear. Nobel laureate **James Mirrlees's** seminal work on "*The Optimum Town*" (2006) provided one of the most rigorous early attempts to formally model how a city should be structured to maximize aggregate social welfare. Mirrlees approached the problem as a social planner's optimization exercise: given a fixed population, a central employment district, and commuting costs that rise with distance, how should land and housing be allocated across space to produce the best possible outcome for residents?

His findings challenged laissez-faire intuitions. Even in a relatively simple model, the unconstrained market does not spontaneously produce the socially optimal spatial arrangement. Residents sort by income and willingness-to-pay for accessibility, generating patterns of residential stratification that reduce aggregate welfare relative to what a planner could achieve. Mirrlees's work established that spatial planning is not merely an administrative convenience — it is a precondition for social efficiency.

This foundational framework opened a rich research agenda: What interventions can bring market outcomes closer to the social optimum? How do transport infrastructure, zoning, and land taxation alter the spatial equilibrium? These questions have driven urban economics research for two decades since.



Efficiency in land use is not a single, self-evident concept. It encompasses spatial alignment, economic productivity, and the minimization of externalities — each of which demands distinct measurement approaches and policy responses. This chapter examines how economists and planners have defined, modeled, and pursued land use efficiency.

Spatial Efficiency

Spatial efficiency refers to the degree to which land use patterns align with strategic planning objectives — including the concentration of development in accessible locations, the preservation of agricultural and ecological land from unnecessary conversion, and the coherent structuring of urban form around transport networks. **Halleux et al. (2022)** emphasize that spatial efficiency is achieved when land is developed in the right places, at the right time, and in the right configuration relative to infrastructure capacity and environmental constraints. Fragmented or leap-frog development, even if individually rational for developers, systematically undermines spatial efficiency at the metropolitan scale.

Economic efficiency demands that each parcel of land be devoted to its highest-value use — the allocation that maximizes the net economic and social output generated per unit of land. In a frictionless competitive market with no externalities, the price mechanism theoretically achieves this: land flows to whoever values it most. In practice, however, land markets are riddled with distortions — zoning restrictions, information asymmetries, externalities, and transaction costs — that prevent this ideal from being realized. Economic efficiency in land use therefore requires identifying and correcting these distortions through targeted policy, rather than simply deregulating markets and hoping for the best.

Urban sprawl — the outward expansion of low-density, car-dependent development across the metropolitan fringe — represents one of the most documented and consequential forms of land use inefficiency in the modern world. **Alex Anas (2019)** provides a rigorous economic analysis of sprawl, demonstrating that it is not merely an aesthetic preference but a systemic market failure with substantial welfare costs.

Sprawl emerges from a combination of underpriced road access, subsidized parking, exclusionary zoning that mandates low densities, and the capitalization of infrastructure costs into general taxation rather than development fees. Each of these distortions individually encourages more dispersed development than is socially optimal; together, they generate the characteristic sprawl patterns visible across the American sunbelt, the European peri-urban fringe, and rapidly urbanizing regions of the Global South.

Reduced Accessibility

Dispersed land uses increase average travel times, reduce transit viability, and limit access to jobs and services for households without private vehicles — compounding social inequality.

Infrastructure Costs

Sprawling development requires extensive road, water, sewer, and utility networks serving low-density areas — dramatically increasing per-capita infrastructure costs borne by all taxpayers.

Lost Agglomeration

Sprawl dissipates the productivity gains that arise from dense co-location of workers, firms, and ideas — reducing the innovation and wage premiums that concentrated urban economies generate.

Environmental Degradation

Conversion of agricultural and natural land to low-density urban uses destroys ecosystem services, fragments habitat, and increases per-capita carbon emissions from car-dependent travel patterns.

The Cost of Sprawl: Inefficiency in Motion



Low-density, car-dependent development patterns consume enormous quantities of land, energy, and public investment relative to the population they serve. The aerial perspective reveals what ground-level experience obscures: a landscape organized around the automobile rather than around human connection, where distances between destinations make walking and transit functionally impossible, and where the ecological fabric of the pre-urban landscape has been comprehensively severed. Every hectare of sprawl represents not just a land use decision, but a decades-long commitment to a particular mode of living — one that research consistently shows generates lower productivity, higher emissions, greater social segregation, and diminished quality of life compared to compact, mixed-use alternatives.

Costas Arkolakis (2016) advances the economic literature on optimal city structure by constructing general equilibrium models that account for multiple competing land uses, transport costs, agglomeration economies, and congestion externalities. His work reveals that finding the optimal spatial allocation of land is far more complex than simply maximizing density everywhere or minimizing travel distances.

1 The Efficiency of Competitive Markets — Under Ideal Conditions

Arkolakis's modeling confirms that in the absence of externalities and market distortions, competitive land markets can achieve efficient spatial allocations. When agents face the true social costs of their location choices — including commuting costs, congestion, and land consumption — decentralized decisions aggregate toward outcomes that a social planner would endorse. This provides a theoretical foundation for market-oriented approaches to land allocation in contexts where distortions are limited.

2 The Inevitability of Externalities

In practice, urban land markets are permeated by externalities. Agglomeration spillovers — productivity gains from proximity to other workers and firms — are not priced into individual location decisions. Congestion costs imposed by each additional driver or commuter are not internalized. Environmental externalities from land conversion are not captured in market prices. Each of these failures drives a wedge between the private optimum and the social optimum, necessitating corrective intervention through pricing mechanisms, regulation, or public investment.



Markets alone cannot achieve socially optimal land use outcomes. This chapter examines the policy instruments available to governments and planners — and the research that guides their design and evaluation.

Land policies constitute one of the most powerful levers available to governments seeking to shape economic and social outcomes. Because land is immobile, its value is profoundly shaped by public decisions — infrastructure investment, zoning designations, service provision, and environmental regulation all flow into land prices, rewarding or penalizing landowners for decisions made collectively by society. **Hartmann (2022)** frames this as both an opportunity and a responsibility: the state's land policy choices are never neutral, always redistributing value and shaping life chances.

1

Zoning and Use Regulation

Zoning assigns permissible uses to parcels, shaping the spatial pattern of development. When well-designed, it separates incompatible uses and protects environmental assets. When poorly designed — or captured by incumbent property interests — it restricts supply, inflates prices, and entrenches segregation. Modern reform movements advocate for mixed-use, transit-oriented zoning that enables density where it is most efficient.

2

Value Capturing

Halleux et al. (2022) highlight value capturing as a particularly important tool for social efficiency. When public infrastructure investment — a new transit line, a park, a school — raises surrounding land values, those gains accrue to private landowners rather than to the public that funded the investment. Value capture instruments — land value taxes, special assessment districts, developer contributions, and betterment levies — reclaim a share of these publicly created gains for reinvestment in the community, improving both efficiency and equity simultaneously.

Liliana Garrido-da-Silva and João Correia-da-Silva (2023) make a significant contribution to the literature by formally modeling what socially optimal land use looks like in a city with heterogeneous firms, workers, and amenities. Their framework moves beyond the simplified monocentric city model to incorporate the spatial distribution of amenities, workplace accessibility, and production cost gradients — producing a richer and more realistic picture of the forces shaping urban land use.

A central finding is that firms' production costs increase with their distance from key amenities and workplace clusters, creating centripetal forces that concentrate economic activity in accessible locations. When market rents reflect these agglomeration benefits, the resulting land use pattern approximates the social optimum — but critically, standard market mechanisms systematically under-supply accessibility in peripheral areas, generating inefficient spatial fragmentation.

The authors propose that **travel subsidies** targeted at peripheral areas can correct this market failure by reducing the effective distance penalty faced by firms and workers in less accessible locations, enabling a more socially efficient spatial equilibrium. This has direct implications for public transit investment and urban transport pricing policy.

Designing for Social Welfare: The City Planner's Blueprint

The ideal city, as conceived by urban welfare economics, is organized around accessibility and the minimization of friction — placing housing, employment, services, and green space in configurations that reduce travel costs while preserving the agglomeration benefits of proximity. Concentric zone models and polycentric network cities represent two influential spatial templates, each with distinct efficiency and equity profiles. The city planner's challenge is to translate these abstract welfare-maximizing blueprints into concrete zoning maps, infrastructure investment programs, and regulatory frameworks that can navigate the political economy of existing property rights, incumbent interests, and fiscal constraints.

Pablo Fajgelbaum and Cécile Gaubert (2025) represent the frontier of research on place-based policies — government interventions that deliberately target specific geographic locations, rather than applying uniform national policies. Their work provides a rigorous welfare-theoretic framework for evaluating when and how such spatial targeting is justified, and what form optimal interventions should take.

→ **The Case for Spatial Targeting**

When agglomeration economies create self-reinforcing concentration in a small number of high-productivity locations, the resulting spatial equilibrium may be inefficient. Workers and firms that would generate net social gains by locating elsewhere fail to do so because they cannot capture the spillover benefits their presence would create in less-developed regions. Place-based policies can correct this by subsidizing activity in locations where the gap between social and private returns is largest.

→ **Quantifying Welfare Gains**

Their quantitative analysis suggests that well-designed place-based policies can generate substantial welfare gains — on the order of several percentage points of aggregate consumption — by correcting the misallocation of workers across locations. These gains are not evenly distributed, however, raising equity questions about who benefits most from spatial reallocation.

CHAPTER 4

The Interplay of Efficiency and Equity

No discussion of land use policy is complete without grappling directly with the equity dimension. Efficient land allocation and equitable distribution of land's benefits are distinct goals — and the policies that advance one do not automatically advance the other. This chapter examines the relationship between efficiency and equity in land use, and the research that helps navigate their interaction.

The tension between efficiency and equity in land policy is not merely a philosophical abstraction — it manifests in concrete policy debates with real distributional consequences. **Thomas Hartmann (2022)** argues persuasively that land policy is inherently redistributive: every zoning decision, infrastructure investment, and development approval alters the distribution of land values and access to opportunity, whether or not policymakers acknowledge this explicitly.



The Efficiency Argument for Density

Dense, mixed-use development maximizes the productive use of well-located land, reduces infrastructure costs per capita, and generates agglomeration economies. Upzoning high-demand areas increases housing supply and reduces the land cost component of housing prices. From a pure efficiency standpoint, the case for density is compelling. However, if densification proceeds without affordability protections, the gains accrue primarily to landowners and high-income newcomers, while lower-income existing residents are displaced.



The Equity Case for Spatial Justice

Equitable land policy demands that historically marginalized communities receive a fair share of the investment and opportunity that efficient land development generates. This may require affirmative requirements for affordable housing inclusion, community land trusts that permanently remove parcels from speculative markets, and participatory planning processes that give low-income residents genuine influence over decisions that shape their neighborhoods. These measures may reduce efficiency in narrow economic terms while producing significant social welfare gains.

One of the most important contributions of recent urban economics has been to quantify the welfare costs of inefficient spatial sorting — the process by which workers of different skills, incomes, and backgrounds end up concentrated in different locations. **Pablo Fajgelbaum and Cécile Gaubert (2020)** develop a rich framework for analyzing how heterogeneous workers choose locations, and what happens when that sorting process is distorted by market failures or policy constraints.

How Workers Sort Across Space

In standard economic models, workers choose locations by trading off wages against the cost of living, amenity values, and idiosyncratic preferences. High-skill workers tend to cluster in high-productivity, high-amenity cities because the wage premium they receive there exceeds the higher cost of living. This sorting generates agglomeration economies — the proximity of skilled workers raises everyone's productivity — but also concentrates housing costs and land values in ways that can exclude lower-income households from the most productive locations.

Fajgelbaum and Gaubert show that the sorting equilibrium that emerges from individual optimization is generally not socially efficient. Workers do not internalize the spillover effects of their location choices — both the positive agglomeration benefits they confer on co-located workers, and the congestion and cost-of-living pressures they impose on residents already in high-demand areas.

Density vs. Sprawl: Finding the Optimal Balance

Neither extreme — hyper-dense concentration nor sprawling dispersal — represents the social optimum. The research literature converges on the view that metropolitan areas benefit from a structured polycentric form: sufficient density in transit-accessible nodes to capture agglomeration economies and support viable public transit, combined with graduated residential density that enables households across the income spectrum to access well-located land. The optimal balance varies by city size, geography, economic base, and cultural preference — there is no single universal template. What is universal is the need to align land use patterns, transport infrastructure, and housing policy in a coherent spatial strategy rather than allowing each to be determined by separate, uncoordinated market and regulatory processes.

The elegant models of spatial welfare economics and optimal land use provide indispensable frameworks for thinking clearly about land policy. But the translation from theoretical optimum to implemented policy is fraught with challenges that the models themselves often abstract away. **Halleux et al. (2022)** provide a grounded analysis of the gaps between the ideal and the achievable in real-world land governance contexts.

Mutual Reinforcement and Blockages

Halleux et al.'s central finding is that spatial efficiency and socioeconomic efficiency can be mutually reinforcing — compact, well-located development tends to generate both lower infrastructure costs and better labor market access — but can also block each other in important ways. Strict spatial efficiency measures (such as urban growth boundaries) may restrict land supply and inflate housing costs, undermining socioeconomic efficiency for lower-income households. Conversely, policies designed to improve affordability (such as permitting low-cost peripheral development) may compromise spatial efficiency by extending the urban footprint beyond infrastructure capacity.

Political Economy Constraints

Even when the theoretically optimal policy is well understood, implementation faces formidable political economy obstacles. Incumbent landowners and property interests that benefit from existing zoning and development restrictions have strong incentives to resist reform. Local governments that depend on property tax revenue have conflicting interests. Distributional conflicts between different income and racial groups over land use decisions generate gridlock. These political constraints are not incidental — they are structural features of land governance that any realistic policy framework must navigate.



The next generation of land use challenges — climate adaptation, technological disruption, demographic transition, and deepening inequality — demands new tools, new frameworks, and a renewed commitment to planning for the common good. This chapter explores the emerging directions that will shape rational land use in the decades ahead.

The rapid expansion of urban data infrastructure — including satellite remote sensing, GPS mobility traces, smart meter networks, planning permit databases, and real-time transport data — is transforming the analytical foundations of land use planning. Where planners once relied on decennial census data and manual traffic counts, contemporary planning agencies can access near-real-time information on how land is actually being used, how people are actually moving, and how the built environment is actually performing against its design intentions.

This data revolution enables a shift from reactive to anticipatory planning. Rather than responding to development pressures after they have already reshaped the urban landscape, data-driven planning systems can model the downstream consequences of different land use decisions before they are made — incorporating population growth projections, climate risk assessments, infrastructure capacity constraints, and economic development scenarios into integrated spatial planning frameworks.

Machine learning approaches are increasingly being applied to predict where development pressure will materialize, identify underutilized parcels with high redevelopment potential, and model the spillover effects of proposed infrastructure investments on surrounding land values. These tools do not replace planner judgment — but they dramatically expand the analytical frontier available to support better decisions.

The climate crisis has fundamentally reframed the stakes of land use decisions. Land use change is responsible for approximately 23% of global greenhouse gas emissions, primarily through deforestation and agricultural intensification. Urban expansion onto carbon-rich soils and ecosystems adds to this toll. At the same time, land is one of the most powerful tools available for climate adaptation — through the preservation and restoration of natural systems that buffer against flooding, heat, drought, and biodiversity loss.



Green Infrastructure Integration

Modern urban planning increasingly treats green space not as an amenity add-on but as critical infrastructure — providing stormwater management, urban heat island mitigation, air quality improvement, and mental health benefits. Land use policies that mandate minimum green coverage, protect urban tree canopy, and require permeable surfaces in new development deliver multiple co-benefits simultaneously, improving both climate resilience and livability.



Ecological Land Protection

Protecting ecologically sensitive land from development — including wetlands, floodplains, urban forests, and agricultural land — requires robust planning frameworks that can resist development pressure over the long term. Transferable development rights, conservation easements, and ecological compensation schemes are among the instruments used to incentivize private landowners to maintain ecological land uses that generate significant public benefits.

Building Tomorrow's Cities: Sustainable, Efficient, Equitable

The city of the future is not a technocratic fantasy of glass towers and autonomous vehicles — it is a place designed around human flourishing, ecological stewardship, and shared prosperity. The research synthesized in this presentation converges on a vision of urban land use that is simultaneously more compact and more green, more productive and more affordable, more data-informed and more democratically governed. Achieving this vision requires moving beyond the false choices that have dominated land use debates — growth versus environment, efficiency versus equity, market versus state — and embracing the integrated, multi-objective frameworks that the best contemporary research provides. The cities that get this right will be the most competitive, resilient, and livable places in the twenty-first century.



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