



MICRO-CREDENTIAL

LAND MANAGEMENT IN CENTRAL ASIA

6.- Rational Land Use and Efficiency

Ecological Balance and Land Use

LM-W06-V41



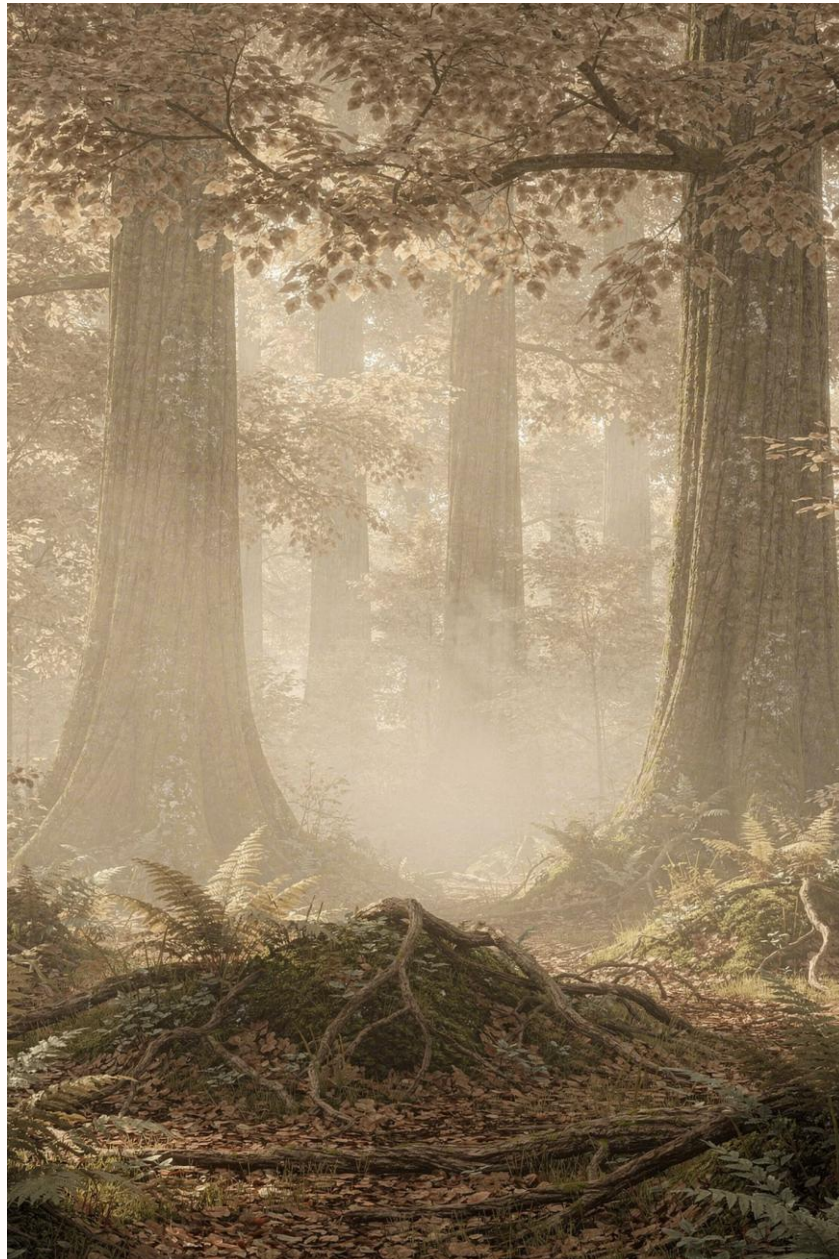
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Ecological Balance and Land Use: A Planet in Transition



Our planet's land is finite — yet the pressures on it have never been greater. This presentation explores the forces reshaping Earth's landscapes, the consequences for biodiversity and climate, and the pathways toward a more sustainable future.



Across the globe, the delicate equilibrium between human activity and the natural world is under mounting stress. Land transformation, resource extraction, and expanding populations are pushing ecosystems toward irreversible tipping points. Understanding the scale of this challenge is the first step toward meaningful change.

A Resource Under Siege

Land is the foundation of human civilization — providing food, shelter, energy, and biodiversity. Yet it is fundamentally finite. As populations grow and consumption patterns intensify, the gap between what land can sustainably provide and what we demand of it widens at an alarming rate.

2 Unprecedented Transformation

The speed and scale of land transformation today surpasses any previous era in human history, driven by technology, trade, and population growth.

Key Pressures

1 1.3 Billion People Trapped

Over 1.3 billion people depend on degrading agricultural land for their livelihoods, with diminishing returns threatening food security and economic stability.

Our appetite for resources is outpacing the planet's capacity to regenerate. From livestock to land clearing, the data paints a stark picture of unsustainable demand.

70%

Agricultural Land

Dedicated to feed crops and livestock production globally — a staggering allocation that crowds out biodiversity.

2x

Resource Consumption

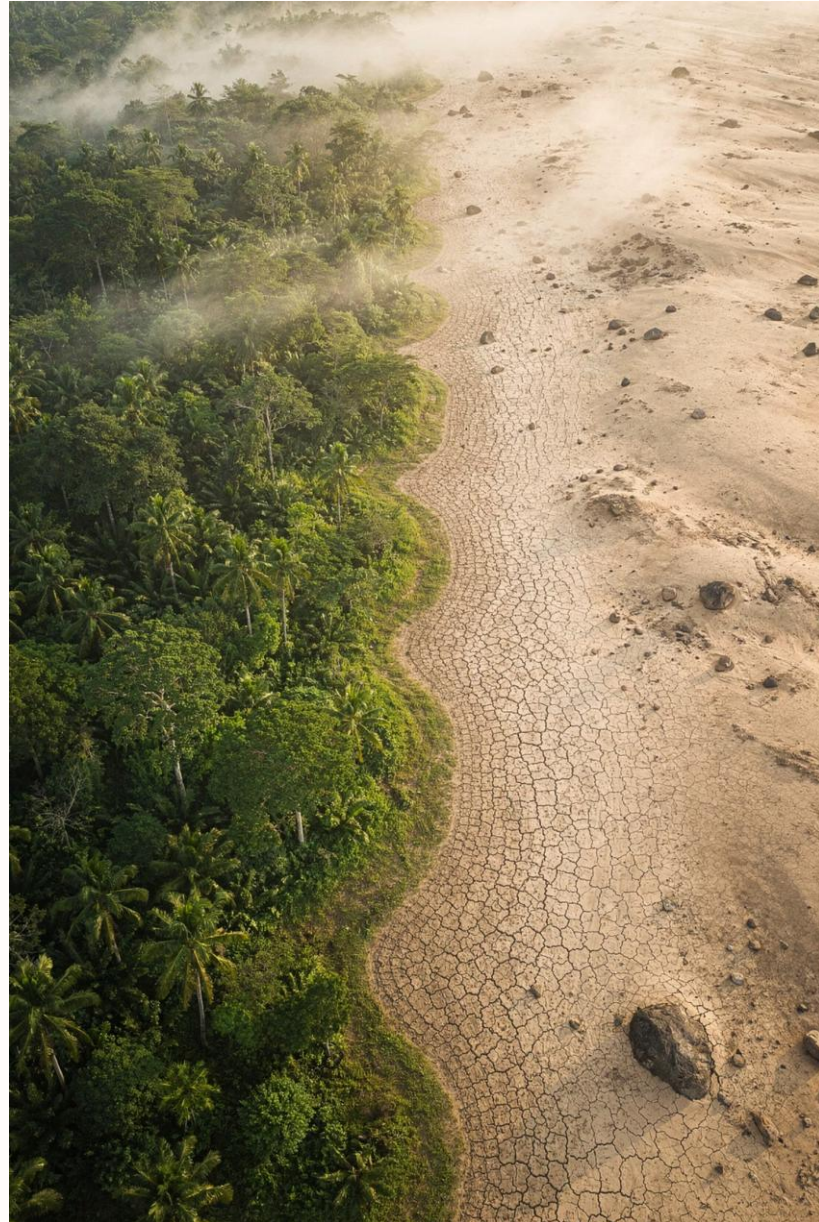
Global natural resource consumption has doubled in just 30 years, reflecting explosive growth in both population and per-capita demand.

3

Planets Needed by 2050

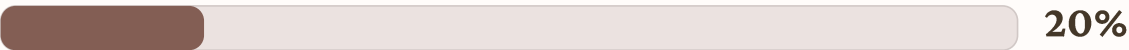
At current trajectories, humanity will require the equivalent of three Earths to sustain its resource demands by mid-century.

75% of Earth's Land Has Been Altered by Human Activity



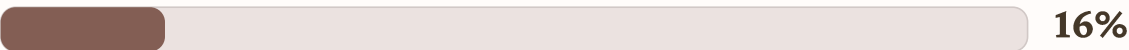
What once took millennia now takes decades. The conversion of wild landscapes into agricultural fields, urban sprawl, and industrial zones represents one of the most profound transformations in the planet's history — and one of the most consequential.

Between 1998 and 2013, a significant share of Earth's vegetated land showed measurable signs of declining productivity — a warning signal that our soils and ecosystems are under severe stress. This decline is not confined to one land type; it cuts across every major category of vegetation.



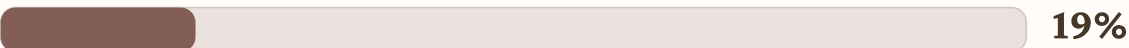
Cropland

Declining productivity due to soil exhaustion and poor management practices.



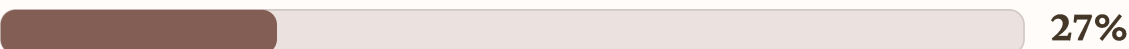
Forest Land

Reduced biological output from logging, fragmentation, and climate stress.



Grassland

Overgrazed and degraded, reducing carbon sequestration and biodiversity.



Rangeland

Cropland at Risk

As of 2000, a projected 2% of global croplands — approximately 30 million hectares — were located in areas destined for urbanization by 2030. These are often the most fertile, well-irrigated lands near population centers.

Compounding Forces

Urbanization does not act alone. Climate change is shifting agricultural zones, while rapidly evolving dietary patterns — especially rising meat consumption in developing economies — amplify demand for land that is simultaneously shrinking.

A Systemic Challenge

The convergence of urban expansion, climate volatility, and shifting consumption patterns creates a systemic challenge that no single policy or technology can solve alone — requiring integrated, cross-sector responses.



Life on Earth is disappearing at a rate unprecedented in human history. The sixth mass extinction is not a future scenario — it is unfolding now, driven primarily by how we use, transform, and degrade land. The consequences for ecosystems, economies, and human well-being are profound and far-reaching.

The Human Cost

The well-being of over **3.2 billion people** is directly undermined by land degradation. From smallholder farmers losing soil fertility to coastal communities losing protective mangroves, the human stakes of biodiversity loss are immense and deeply inequitable.

The Projected Loss

Biodiversity loss is projected to reach **38–46% by 2050** under business-as-usual scenarios — a collapse of natural systems that underpin our food, water, and climate stability.

Habitat Degradation

Even where land is not fully converted, pollution, fragmentation, and invasive species reduce habitat quality below the threshold needed to sustain diverse life.

Primary Drivers of Loss

→ Habitat Transformation

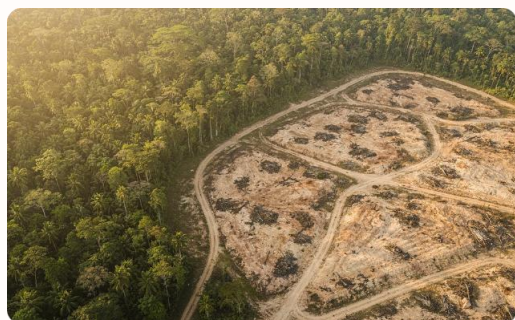
The conversion of forests, wetlands, and grasslands into farmland and human settlements destroys the ecological niches that species depend upon for survival.

1 Million Species Threatened with Extinction



From the Bengal tiger to coral reef ecosystems, the web of life is unraveling. Species that evolved over millions of years face elimination within decades — the irreversible loss of biological heritage that once lost, can never be recovered.

Of all the forces reshaping Earth's landscapes, the conversion of wild land for agriculture stands as the dominant driver of biodiversity loss and ecosystem disruption worldwide.



Forests Sacrificed

Vast tracts of tropical and temperate forest are cleared annually to meet demand for food, feed, fiber, and bioenergy. Each cleared hectare eliminates complex habitat that supported thousands of interdependent species.



Wetlands Drained

Wetlands — among the most biodiverse and carbon-rich ecosystems on Earth — are drained and converted for agriculture at an alarming rate, destroying natural water filtration and flood mitigation services.

Ancient grasslands and savannas, home to extraordinary biodiversity, are increasingly plowed under for crop production — eliminating native plant communities and the wildlife that depends on them.

The ecological consequences of converting the Cerrado extend deep into the soil — disrupting the invisible biological systems that sustain long-term productivity and watershed health.



Soil Biology Disrupted

Conversion to agriculture causes a dramatic decrease in microbial biomass — the living engine of nutrient cycling and soil fertility. Simultaneously, the metabolic quotient (qCO_2) increases, indicating that soil microbial communities are under severe stress and consuming more energy just to survive.



Hydrology Destabilized

Without the deep root systems and ground cover of native Cerrado vegetation, rainfall that once infiltrated slowly now rushes across the surface. This increases overland flow, accelerates soil loss through erosion, and raises the risk of destructive gully formation — permanently scarring the landscape.

The Cerrado's soils and vegetation store vast amounts of carbon accumulated over thousands of years. Conversion releases this carbon rapidly into the atmosphere, contributing significantly to greenhouse gas emissions and undermining Brazil's climate commitments.

The Interconnectedness of Land and Climate



Land and climate are inseparable. How we manage — or mismanage — the world's landscapes directly shapes the trajectory of global warming, while a changing climate simultaneously transforms what those landscapes can support. This two-way relationship lies at the heart of the sustainability challenge.

Part of the Problem

When forests are cleared, wetlands drained, and soils degraded, enormous quantities of stored carbon are released into the atmosphere. Agriculture, deforestation, and land degradation collectively account for roughly **23% of global greenhouse gas emissions** — making land use a major driver of climate change.

Part of the Solution

Healthy soils, forests, and wetlands act as powerful carbon sinks — absorbing CO₂ from the atmosphere and storing it for decades or centuries. Protecting and restoring these ecosystems offers some of the most cost-effective and immediately available climate mitigation options we have. Land is not just part of the problem — managed wisely, it is an essential part of the solution.

The global food system is one of the most powerful drivers of both land degradation and climate change — yet it also holds enormous potential for transformation.

Food Lost & Wasted

25–30% of all food produced globally is lost or wasted before it can be consumed. This represents a staggering misuse of land, water, energy, and labor — while contributing needlessly to emissions.

Livestock & Methane

Livestock production accounts for nearly **41% of human-caused methane emissions** — a potent greenhouse gas with over 80 times the short-term warming power of CO₂. Reducing meat consumption is among the highest-impact dietary changes individuals can make.

Dietary Shifts

Shifting diets toward plant-rich foods can significantly reduce land use, water consumption, and emissions — while improving public health outcomes. The food choices we make collectively reshape landscapes at a planetary scale.



Behind every wasted meal lies a hidden footprint: cleared forest, drained aquifer, emitted greenhouse gas. When we discard food, we discard the land and resources that produced it. Tackling food loss and waste — from farm to fork — is one of the most impactful levers available for reducing pressure on the world's land and climate systems. It requires action across production, supply chains, retail, and consumer behavior simultaneously.



The challenges of land degradation, biodiversity loss, and climate change are immense — but they are not insurmountable. A growing body of evidence points to practical, scalable solutions that can restore ecological balance while meeting human needs. The transition requires ambition, innovation, and integrated thinking across sectors and scales.

No single solution can address the full complexity of land degradation. Effective responses must work simultaneously across management, supply chains, and risk frameworks — delivering multiple benefits at once.

Land Management

Practices such as soil restoration, agroforestry, cover cropping, and wetland conservation directly improve land health while sequestering carbon, enhancing biodiversity, and improving water cycles. These approaches offer immediate, on-the-ground impact.

Value Chain Management

Reducing food loss and waste, shifting consumption patterns, and improving supply chain transparency can dramatically reduce the land footprint of global food systems without requiring new land conversion.

Risk Management

Building resilience into agricultural systems through diversification, insurance mechanisms, and early warning systems helps communities adapt to climate shocks without resorting to further land degradation.



Great Green Wall of the Sahara

Spanning 11 countries across Africa's Sahel region, this ambitious initiative aims to restore 100 million hectares of degraded land by 2030. It combats desertification, builds food security, and creates green jobs — demonstrating that restoration at continental scale is achievable.

Agroforestry & Water Harvesting

Integrating trees with crops and livestock, and capturing rainwater with simple earthworks, creates drought-resilient farming systems that produce food while restoring ecosystem services — a powerful combination of adaptation and mitigation in a single practice.



Three North Forest Shelterbelt (China)

One of the world's largest reforestation programs, China's "Green Great Wall" has planted billions of trees across the arid north since 1978 — combating desertification, reducing soil erosion, and sequestering significant quantities of carbon over four decades.

One of the central debates in sustainable agriculture is how best to balance food production with biodiversity conservation. Two contrasting philosophies offer different answers — and the evidence suggests both have a role to play.

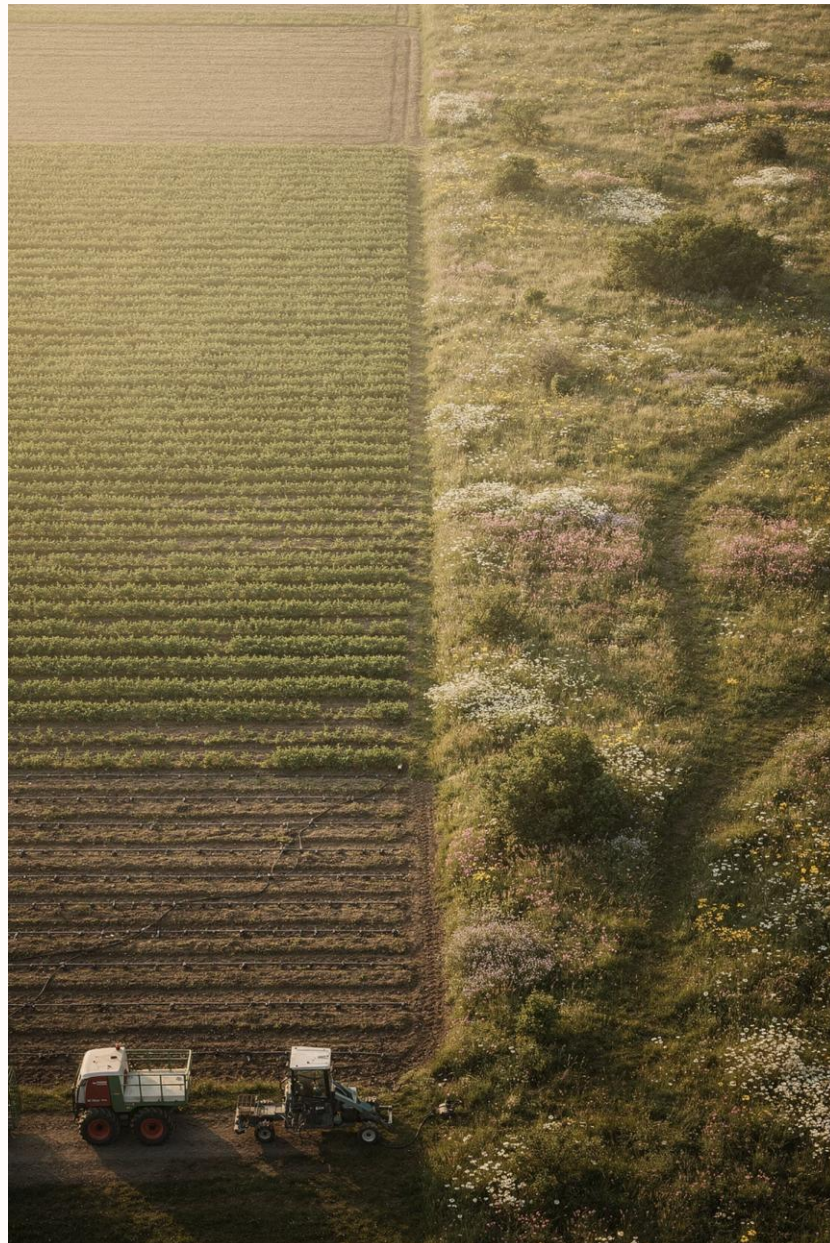
▣ **Sustainable Intensification (Land Sparing)**

By dramatically increasing crop yields per hectare through technology, precision agriculture, and improved practices, we can produce more food on existing land — freeing up other areas to be restored or protected for biodiversity. This approach prioritizes efficiency and separation of production from nature.

▣ **Agroecology (Land Sharing)**

Rather than separating agriculture from nature, agroecology integrates ecological features — diverse crops, hedgerows, wetland buffers, and native plantings — directly within agricultural landscapes. This supports biodiversity on working land while maintaining productivity, building soil health, and enhancing resilience.

Two Visions for the Agricultural Landscape



Both land sparing and land sharing recognize that how we farm matters as much as how much we farm. In practice, the most resilient food systems will blend the precision of sustainable intensification with the ecological wisdom of agroecology — producing enough for a growing world without sacrificing the natural systems that sustain us all.

A Continent-Scale Commitment

The European Union has set ambitious targets for its land use sector to contribute to achieving climate neutrality, while simultaneously protecting and restoring biodiversity across the continent.

01

Efficient Land Use

Maximizing productivity per hectare while minimizing environmental footprint — directing development away from the most ecologically sensitive areas.

02

Sustainable Biomass

Aligning biomass consumption for energy and materials with the planet's biological regeneration capacity — ensuring forests and soils remain net carbon sinks.

03

Peatland Restoration

Projected GHG emission reductions from EU agriculture and peatland restoration by 2045 represent one of the largest land-based climate contributions available to Europe.

A Call to Action: Prioritizing Working Lands

Securing the future of the planet's working lands requires a fundamental shift in how we value land — moving beyond short-term economic returns toward a fuller accounting of ecological services and long-term resilience.

Blend Conservation with Production

Agricultural landscapes need not choose between productivity and wildlife. Integrating habitat features — native plantings, riparian buffers, pollinator corridors — into working farms can deliver conservation outcomes at scale without removing land from production.

Incentivize Optimal, Not Maximum, Production

Policy frameworks and financial incentives must be redesigned to reward farmers for sustainable, ecologically sound production rather than simply maximizing yield. Native biodiversity and soil health have real economic value that current markets fail to capture.

Redefine the "Best Use" of Land

The highest economic return from a parcel of land is not always its best use. A floodplain restored to wetland, a hillside returned to forest, or a hedgerow left intact may generate more total value — in carbon storage, water filtration, and biodiversity — than any crop it could replace.

The Future We Choose: Balancing Needs for a Thriving Planet

The decisions we make about land in the coming decade will define the ecological inheritance we leave for future generations. The science is clear: by embracing **sustainable land management**, shifting toward **plant-rich diets**, reducing food waste, and scaling **innovative restoration solutions**, we can restore ecological balance and ensure a future worth inhabiting — for people and for all life on Earth.

Define Sustainability

Establish clear, science-based boundaries for land use that respect planetary limits.

Mitigate Habitat Loss

Protect what remains, restore what has been lost, and transform how we produce what we need.

Act Now

The window for effective action is narrowing. Every year of delay forecloses options and deepens the crisis.



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