

10 FACTS ABOUT LAND SYSTEMS FOR SUSTAINABILITY



A REPORT FOR POLICY AND PRACTICE



WHY LAND MATTERS

KEY TAKE-AWAYS

This report accompanies [“Ten Facts About Land Systems for Sustainability,”](#)

a peer-reviewed work of a group of scientists led by the Global Land Programme who synthesized knowledge across the field of Land System Science (LSS) into 10 facts with strong, widespread, empirical support.

Land systems are the key element to overcoming existential challenges that humanity is facing and to achieving sustainable development. Wise use of global land is at the heart of:

- Securing the livelihood of millions of farmers
- Shaping sustainable food production
- Eradicating poverty and overcoming inequalities
- Valuing different cultures and worldviews, especially those of indigenous peoples and local communities
- Empowering women and ensuring gender equity
- Making cities and urbanization sustainable
- Mitigating and adapting to climate change and conserving biodiversity

At the same time, land use generates many sustainability challenges. More than any other global change, our use of land continues to transform this planet, giving rise to climate, biodiversity, and food security issues that threaten a sustainable human future. Responses are often formulated as single, silver bullet solutions. Instead, policymakers should understand these issues as “wicked problems” where clear definitions and easily identified solutions are elusive. More and more, land is a limited resource on which there are multiple, growing, and competing claims.

INTRODUCTION

Land systems are complex, dynamic, and interdependent social-ecological systems, blending activities of people with the rest of nature. The 10 facts that follow will help policy and decision makers understand the underlying realities of land system changes, including the risks and approaches that are likely to lead to failures in land use decisions. The key take-aways listed here identify potential solutions best developed through collaborative processes, engaging all stakeholders throughout the decision-making process to avoid creating and/or reinforcing existing inequalities.

MORE SUSTAINABLE AND JUST SOLUTIONS REQUIRE:



Just Solutions to Land Challenges Acknowledge Multiple Perceptions, Beliefs, and Values, the Multiple Visions of Justice, and Power Differentials.



Solutions Are More Successful When They Are Contextual and Adaptive, Avoiding Silver Bullets or “One-Size-Fits-All” Panaceas.



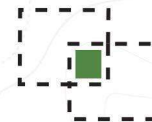
Governance of Land Systems Is More Effective When Considering Spillovers across Spatial and Temporal Scales.



Policies and Management That Prevent Undesired, Irreversible Impacts Bring More Overall Benefits than Trying to Restore Land Afterward.



Land-Use Decisions That Foster Synergies Are Important but Need to Be Combined with Mitigating Unavoidable Trade-Offs and Managing Demand.



To Avoid Reinforcing Inequalities, Governance Interventions Need to Explicitly Address Inequalities and Acknowledge Unclear Land Tenure.

NO. 1



MULTIPLE VALUES AND MEANINGS

LAND HAS MULTIPLE MEANINGS AND VALUES

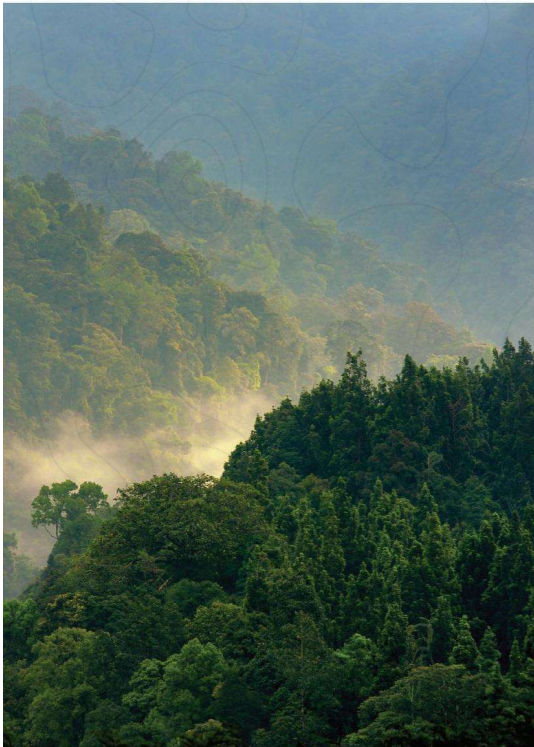
Land use provides food, energy, and raw materials to human societies. Understandings of land as being “valued,” “useful,” or “degraded,” are also deeply cultural and symbolic. Yet, even as people perceive land changes differently, some changes, such as soil erosion, have observable negative impacts on human societies.

These multiple values, meanings, and “ways of knowing” complicate international efforts to address degradation and restoration. Efforts such as the United Nations Convention to Combat Desertification and Sustainable Development Goals show why top-down policy agendas, often rooted in one dominant value system, can be contentious and resisted and underline the need for land governance processes that bridge diverse knowledge and values.



LAND DEVELOPMENT IN THE AMAZON: “THE VERY SAME TREES”

Take, as an example, a large stand of trees at the edge of an Amazonian forest. Soy farmers see the massive and diverse standing trees as barriers to be cleared, giving place for the export cash-crop monoculture that is their livelihood. In contrast, indigenous peoples who have been living for millennia with and within the forests see medicines, fibers and resins for construction, food and spiritual purposes in these very same trees. International NGOs and governments, in contrast, might see the very same trees as a key sequester of carbon, mitigating global climate change and fulfilling international obligations. Durable land use decisions about how to manage this stand of trees require land governance processes that bridge diverse knowledge and values to ensure that distinct viewpoints are accounted for, trade-offs are acknowledged, and all parties are motivated to support agreed-upon solutions.



CHALLENGE 1:

NOTIONS OF LAND DEGRADATION AND RESTORATION ARE SOCIALLY CONSTRUCTED AND CONTESTED

Actors’ different visions of degradation or restoration are based not only on contrasting economic interests but different social and biocultural values. Disagreements emerge not only about how, but whether, to rehabilitate or restore specific areas.

LAND AS COMPLEX SYSTEMS



Land systems are complex and behave in unexpected ways. Policy interventions, intended to solve a particular problem, can fail when they ignore this complexity. This results in unintended harm to ecosystems as well as their services and goods to people that ensure human well-being.

For example, payment schemes for ecosystem services rely on predicting what would have happened without the intervention. Some policymakers have developed systems with the goal of reducing deforestation or degradation to ensure emission reductions. Polluters purchase carbon credits and those funds are meant to be used to compensate people who would otherwise earn a living through logging or other environmentally harmful activities. However, land systems can undergo periods of abrupt change, e.g., large-scale deforestation in southeast Asian countries, rendering inaccurate any predictions of carbon capture calibrated on past land use trends.

UNINTENDED CONSEQUENCES IN SOUTHEAST ASIA: OIL PALM INTENSIFICATION

Even seemingly rational interventions can fail. For example, oil palm production is a cause of extensive deforestation in Indonesia and Malaysia. A rational policy response might be to promote intensification, i.e., improvements in agricultural productivity, to produce more palm oil and revenue on land that has already been disturbed to protect remaining forestland. But by enhancing profitability of oil palm cultivation, this intervention may in fact induce farmers to expand oil palm plantations even more. This phenomenon is known as the “rebound effect.” Instead, a combination of policies that improve agricultural productivity and directly restrict oil palm expansion would be more effective at reaching the stated policy goal.

CHALLENGE 2: CONSEQUENCES ARE DIFFICULT TO FORESEE AND TRACE

Although small-scale interactions may be easy to observe or define, ripple effects can be hard to accurately predict. Developing policy options that are more likely to be effective requires considering multiple perspectives, including how such policies might inadvertently lead to new or different challenges.

LAND AS COMPLEX SYSTEMS

NO. 2



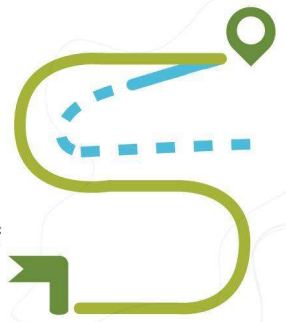
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IRREVERSIBILITY AND PATH DEPENDENCE

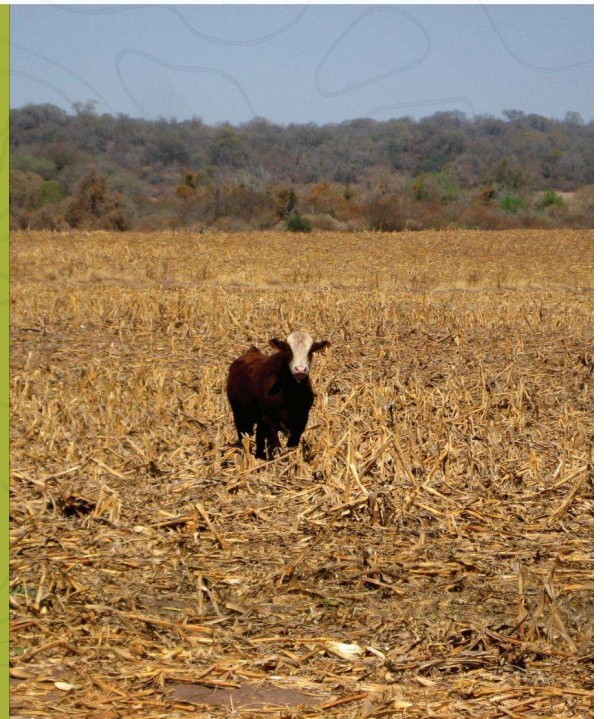
IRREVERSIBILITY AND PATH DEPENDENCE

The conversion of land from one use to another, such as the clearing of old-growth forests or peatland drainage, or farmland to urban area, leads to impacts that will resonate over decades or centuries. Land use policy is usually made over the course of a decade or less, but that policy rarely focuses on the long-term impacts of decisions made. Though crucial, restoration efforts may not bring land back to a state that truly matches pre-conversion conditions. In some cases restoration may not be possible due to current land use. Different environmental, institutional, and behavioral processes can combine to create such “lock-in” situations that reduce the resilience of systems.



LAND CLEARING IN SOUTH AMERICA: NOT ALL FORESTS ARE EQUAL

A key finding of the Global Forest Resources Assessment 2020 is that global net forest area declined by 5 million hectares (ha)/year over the decade of 2010–2020. But digging deeper there was deforestation of 11 million ha/year offset by forest expansion (through a combination of natural regeneration and afforestation) of 6 million ha/year. Yet, planted, restored and even naturally regenerated forest cannot fully compensate for the loss of biodiversity and ecosystem services from primary forest, even if they are all included in the same “forest” statistics. For example, between 1985 and 2020, the Chaco ecosystem of tropical dry forest and woodlands in South America lost over 19.3 million hectares of its natural ecosystems, representing 28% of its area. The region is home to astonishing biodiversity, much of it not yet identified and described.



CHALLENGE 3: LOSS OF OPTION VALUE, SHIFTING BASELINES, NO RETURN TO ORIGINAL STATE

Many land areas have been altered and now provide fewer ecosystem benefits than expected. Perceptions of land as an inherently-plentiful resource, as seen in the huge enthusiasm for land-based climate solutions, runs counter to ecological and social viability. Sound policies need to take full account of these realities.

LARGE IMPACTS OF SMALL FOOTPRINTS



Some land uses, although seemingly local and appearing to impact only a small area, can have large impacts that spill over into surrounding regions and beyond. Cities, for instance, consume large amounts of energy and other resources, often produced elsewhere using vast amounts of land, and air pollution from cities can reduce crop yields across large regions.

Yet cities can also reduce negative impacts on other lands, for instance on biodiversity, by concentrating human populations on a relatively small land footprint.

Roads, though having a small footprint, trigger huge transformations in territories, such as by channeling built-up expansion. Intensive agriculture, coupled with appropriate conservation policies, can spare land from being cleared elsewhere. It's very challenging to predict the impact of a particular policy when ramifications are spread out and not always visible.



THE CHALLENGE OF AGRICULTURE: HIGHER YIELDS OFTEN COME WITH BIGGER ENVIRONMENTAL IMPACTS

Small patches of intensive cropland can generate large production thus reducing the need to cultivate elsewhere, when coupled with appropriate conservation policies. But intensive agriculture may also generate high environmental impacts in the surroundings through nutrients leaching, pesticide use impacting on biodiversity in natural habitats, and high fossil fuel emissions through machinery and fertilizer production.

CHALLENGE 4: SPILLOVERS MAY BE MORE SIGNIFICANT THAN DIRECT IMPACTS

When weighing policy priorities and choices in land use, multiple sources of information and evidence are needed to understand spillover effects – that is, unanticipated impacts that often affect distant areas – versus direct impacts. Diverse perspectives and data increase the chances of being able to consider spillover effects that might result from land use policy.

LARGE IMPACTS OF SMALL FOOTPRINTS

NO. 5



DISTANT CONNECTIONS

DISTANT CONNECTIONS

Globalization means that decisions on how to use any single piece of land can be influenced by distant people, policies, or organizations, and decisions in one place can have large consequences elsewhere. These “couplings” link ecosystem services and benefits from land, appropriating them from rural areas towards cities, as well as internationally via both sea and air.



THE ELECTRIC CAR CONUNDRUM: DEMAND FOR MINERALS IN MOZAMBIQUE

Energy transition, e.g., to electric cars in high-income countries, creates surging demand for minerals like graphite or lithium. This increased demand leads to high land use impacts around mining operations in countries such as Mozambique, which has one of the largest graphite deposits in the world. These impacts include soil removal, population and agricultural lands resettlement, infrastructure development, and forest clearing for construction materials and energy. Another example is that increases in forest cover in high and middle-income countries is linked to deforestation in other countries, often in tropical regions. Political pressures by wealthier countries lead to land use policies to conserve forests or reduce environmental pressures, which simply displaces forest use beyond their borders, exporting biodiversity loss and change.

The impact of trade on land use is mixed; some arrangements concentrate production on land with the highest efficiency, but others lead to expansions into less-suitable areas. For example the production of soybeans and corn to satisfy largely foreign demand for food and feed is leading to deforestation in the humid forests (Amazon), wetlands (Pantanal), and dry forests and woodlands (Argentina’s Gran Chaco and the Brazilian Cerrado). These areas are the source of tremendous planetary biodiversity and are important to protect.

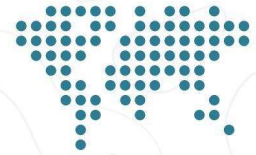


CHALLENGE 5: SOLVING LOCAL PROBLEMS CAN DISPLACE ISSUES ELSEWHERE

Along with improved sources of data on these global dynamics and their relationship to land, decision makers should work to obtain precise information about how local actions affect distant people and places.

WE LIVE ON A USED PLANET

People directly inhabit, use, or manage well over three-quarters of Earth's ice-free land, with more than 25% inhabited and used by Indigenous Peoples and Local Communities (IPLC). Even lands seemingly uninhabited or unused are connected with people in different ways; no change in land use is free of effects on people or planet. Some land uses can have large environmental impacts, including land clearing and tillage for agriculture, mining, settlements, grazing, forest harvests, and hunting. But even landscapes shaped by intensive agriculture can be reshaped to produce benefits beyond just commodities, including space for nature, mitigation of air and water pollution and urban heat, water provisioning, carbon sequestration, and cultural and psychological contributions to human well-being. Land is increasingly in demand to expand agricultural, bioenergy and timber production, cities, nature conservation, carbon sequestration and a range of other uses. These demands compete with the needs of local people's livelihoods, or can support them, depending on policy design.



MAASAI HERDERS: COEXISTING WITH EAST AFRICAN MEGAFaUNA

The most diverse megafauna landscapes remaining on Earth—home to lions, elephants, endangered black rhinos, and African wild dogs—are also home to the cattle-raising Maasai people of East Africa who for centuries have proscribed wild game hunting and consumption. This unrivaled capacity for wildlife coexistence has often been ignored by conservationists, creating conflicts among people and wildlife and limiting conservation success. Today, community-based conservation strategies built on indigenous rights and traditional practices are being directed toward local needs, including through improved infrastructure, education, and livelihoods while also sustaining wildlife and tourism.

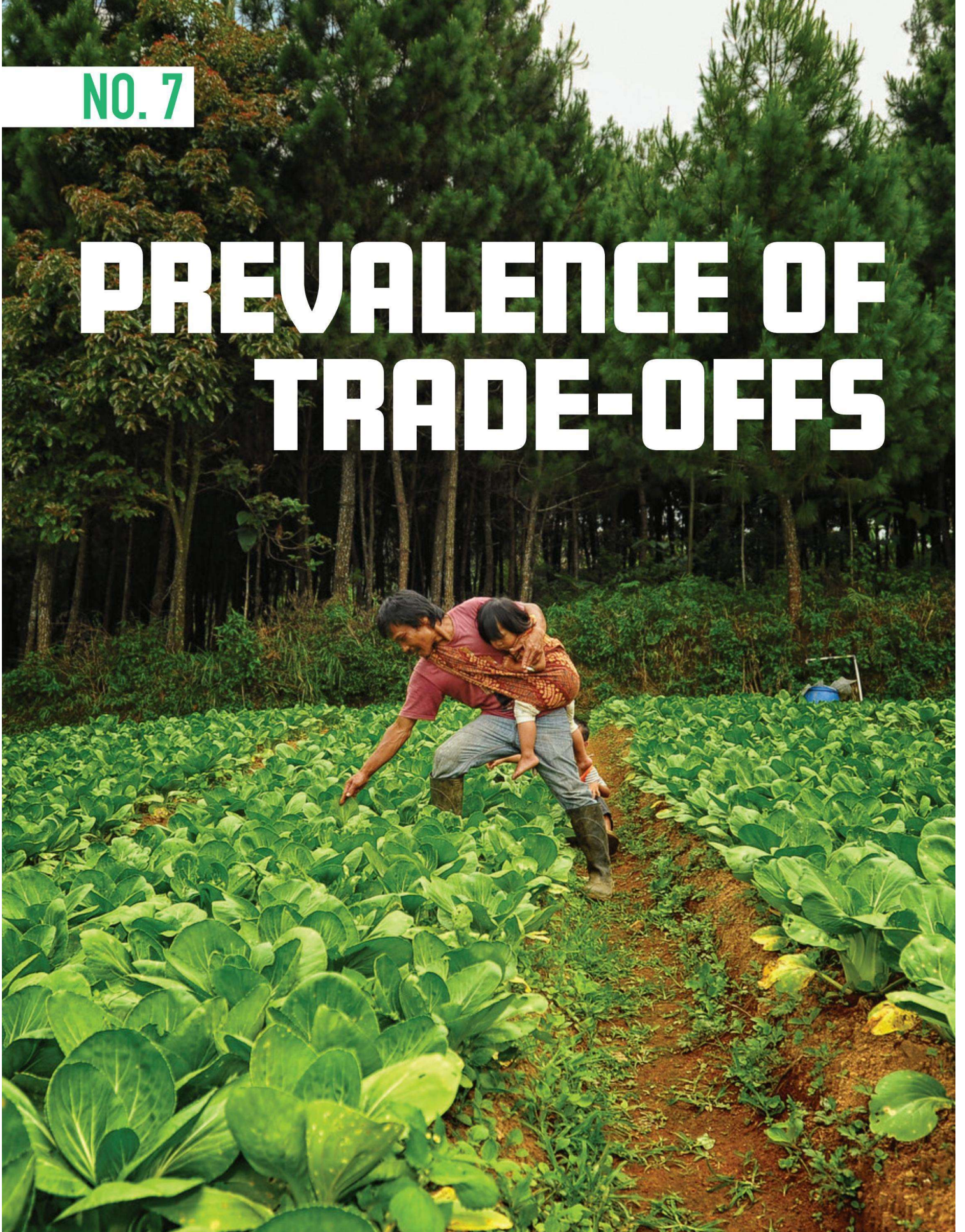
CHALLENGE 6: NO “FREE” LAND THAT DOES NOT ALREADY PROVIDE BENEFITS

Even land perceived as “unused” or available for new uses is always already contributing multiple services, goods and benefits to human societies, near to and distant from that land. These benefits include carbon sequestration, water storage, and wildlife habitat, among others.

WE LIVE ON A USED PLANET

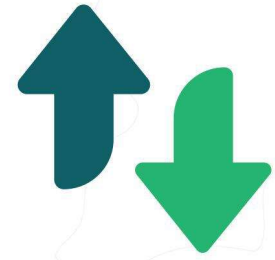
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PREVALENCE OF TRADE-OFFS



PREVALENCE OF TRADE-OFFS

Land uses deliver a range of benefits, producing food and fodder, protecting watersheds, offering cultural and sacred spaces, carbon sequestration, and nature conservation. But any specific piece of land cannot deliver them all simultaneously. Trade-offs among these uses are ubiquitous.



A classic trade-off occurs when land designated for tree planting for climate change mitigation forecloses options to produce food, grazing or other livelihood-related activities for local populations. Yet, a view particularly prevalent in the Global North prioritizes tree planting in the interest of benefiting nature and climate without acknowledging these choices' impact on the communities that are directly affected. Trade-offs such as these attempt to balance the fact that different groups of people, in different locations, or across different generations, experience the benefits or dis-benefits from land use in different ways.

EVEN “GREEN” LAND USE HAS ENVIRONMENTAL IMPACTS

Land use decisions can also involve “green-on-green” choices which attempt to balance different desired environmental outcomes. For example, a decision to foster organic agriculture to minimize pollution might come at the tradeoffs of larger area demand because of lower yields compared to conventional agriculture; or efforts to build renewable energy infrastructure might require considerable land and foreclose other land use options.

Land use decisions involve value judgments to determine and balance these choices. Often land use that is economically beneficial in the short term, or the land use valued by those in power, takes precedence. Synergistic land uses can help mitigate some of the negative social and environmental impacts of land use decisions. For example, intensification and improved integration of crop and livestock systems can achieve environmental conservation goals as well as economic advantages. Such “win-win” opportunities are likely to occur only if science works side-by-side with practitioners and policy makers to learn together.



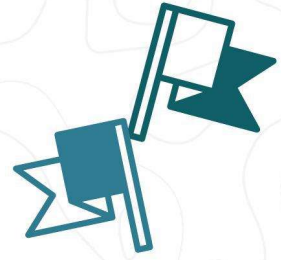
CHALLENGE 7:

PRIORITIZING A SINGLE GOAL (SUCH AS CARBON SEQUESTRATION) REDUCES OTHER BENEFITS FOR SOME

Those working to make best use of resources often choose narrow goal-setting to optimize impact for a specific policy priority. But narrow goals have impacts on other potential uses of land.

MULTIPLE OVERLAPPING AND CONTESTED LAND CLAIMS

Access to land is established through ways of making claims, of which legal titles are only one form. Rights can overlap, belong to different people, or to different kinds of access as in rights to ownership versus use. There are multiple forms of claims, which are not always considered equal; in some places physical or cultural claims are more important than legal/administrative claims, for example.



LAND TENURE IN AUSTRALIA: REINSTATING INDIGENOUS LAND RIGHTS

Land tenure in Australia has two major legal categories, “freehold” privately-owned land, and “crown land” under various branches. But tenure can be complicated, as a single parcel often has several distinct tenure interests associated with it such as for minerals use, and Indigenous rights overlap with most other tenure categories. Some aboriginal communities are able to “self-declare” their lands as Indigenous Protected Areas and, in some cases, are now joint managers of National Parks declared under Australian law. These efforts to reinstate rights, or joint rights, is one way that land management is being used for redress, since Europeans declaring it was Terra Nullius (unoccupied) to appropriate it via legal title.

In many countries, large-scale mining, agricultural, and forestry concessions overlap with indigenous or community lands. In fact, evidence of widespread

tenure overlaps exist for countries such as Brazil, which has overlapping claims on 50% of the total registered public or private territory. In urban areas, competing and overlapping claims to land is a central issue framed around “rights to the city,” including rights to decide on whether land is used for private real estate development or public recreation, shopping, or social housing.

These unclear and contested claims may be resolved by land formalization, or government programs to enhance land tenure security, which can play an important role in environmental conservation or agricultural productivity. But such actions can also contribute to increased environmental degradation or social marginalization, for example, titling lands only to male heads of household, or unequal benefit-sharing in payments for ecosystem services schemes.

CHALLENGE 8:

IDENTIFYING STAKEHOLDERS AND BALANCING CONFLICTING CLAIMS IS CHALLENGING

People and groups serve multiple roles in society, with overlapping interests; this social complexity can undermine the effectiveness of interventions if not acknowledged and incorporated into the land use decision-making process.

MULTIPLE OVERLAPPING AND CONTESTED LAND CLAIMS

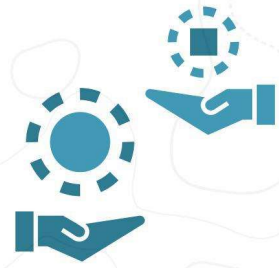
NO. 9

A photograph of a woman in traditional African attire, including a patterned headwrap and a floral-patterned top, carrying a sleeping baby on her back. The baby is wrapped in a blue and orange patterned cloth. The woman is looking down at the ground, and the background shows a rural, wooded area. The text "UNEQUAL DISTRIBUTION OF BENEFITS" is overlaid in large, bold, white capital letters at the bottom of the image.

UNEQUAL DISTRIBUTION OF BENEFITS

UNEQUAL DISTRIBUTION OF BENEFITS

Land distribution is highly unequal. Globally, farms below 2 ha represent around 84% of farms but cover only ~12% of total farmland, and the poorest 50% of rural households only control ~1 to 10% of land by value. Risks, such as climate change impacts on yields, also disproportionately affect poor populations in particular in drylands and pastoral systems.



THE OTHER AMAZON: WITHOUT POLICY INTERVENTIONS, INEQUALITY PRESERVES INEQUALITY

Distribution does not evenly correspond to production: farms under 2 hectares represent 24% of agricultural area but produce 30 to 34% of food supply. This dynamic exists despite smallholders disproportionately living on less-favored agricultural land and in remote areas. In Mozambique, 34% of the agricultural land is divided into plots smaller than one hectare, with one hectare being the average landholding of a farming household. In contrast, Jeff Bezos is among the largest private landowners in the United States, holding approximately 170,000 hectares. The top 10% of landowners—across urban and rural areas—owns between 35 and 80% of the land area and 45 and 60% of the land value, across a set of low- and middle-income countries.

Inequality in land ownership is often further aggravated by correlated social (ethnic, caste, or gender) hierarchies. Such inequalities in land ownership also often translate into inequalities of access to resources on so-called common lands.

Land-use interventions are likely to reinforce or reproduce these current inequalities unless they explicitly address them. Inequality prevails in the absence of equalizing forces.



CHALLENGE 9:

INTERVENTIONS ALWAYS HAVE DISTRIBUTIONAL CONSEQUENCES

Interventions can be perceived as neutral but always result in winners and losers. Given power differentials, policy interventions can result in less control and access for marginalized populations unless decision makers deliberately address inequities.

MULTIPLE DIMENSIONS OF JUSTICE

In contemporary land dynamics, people mobilize multiple visions of justice.

As land is home, and identity and land may be linked to the marginalization of peoples by states or society, some groups are increasingly mobilizing forms of recognition justice, the acknowledgment that some groups' distinct identities and histories are particularly and intimately linked to their lands. Land use may also underpin issues of procedural justice, which regards the concrete processes of decision-making about land: who decides, and how, and on what terms, interests are considered. Also relevant is distributive justice—how goods and harms are distributed or concentrated—among people, including land ownership but also other degrees of access or rights to harvest natural resources. Finally, irreversible impacts on land that occur over multiple human generational timescales requires consideration of intergenerational justice, as land-use dynamics may constrain benefits to future generations or their opportunities.



FOREST LAND MANAGEMENT IN INDIA: SHIFTING POWER

India's landmark Forest Rights Act (FRA) of 2006 seeks to redress multiple injustices incurred during and just after British colonization. These include the non-recognition of forest-dwellers' presence and customary rights, the distributional injustice of commercially oriented forestry, and the procedural injustice of the 1980 Forest Conservation Act that regulated forest conversion without involving forest-dwellers in decisions. Recognizing the complexity of the idea of "rights," the FRA tries to allow for an overlap between forest access rights and forest management rights. Similarly, recognizing more modern conservation goals as not entirely illegitimate, the Act provides a more just decision-making process if and when an eviction should happen, typically in order to save wildlife. Where implementation has focused on re-establishing community rights over forests, a significant shift is palpable in the power relations between historically marginalized communities and the forest bureaucracy.



CHALLENGE 10: GOVERNANCE PROCESSES THAT DO NOT ACKNOWLEDGE DISTINCT FORMS OF JUSTICE WILL LIKELY BE CONSIDERED UNJUST BY SOME

Governance processes are not neutral. Many interventions over-rely on legal or other formal, inherited mechanisms created by previous generations instead of exploring hybrid and more inclusive processes that acknowledge competing rights and interests among stakeholders.

MULTIPLE DIMENSIONS OF JUSTICE

**UNLOCKING THE POTENTIAL
OF LAND SYSTEMS TO
HELP REALIZE JUST AND
SUSTAINABLE
DEVELOPMENT:**

**IMPLICATIONS
FOR POLICY/
PRACTICE/ACTION**

IMPLICATIONS

governance and practice



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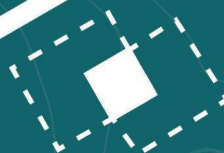
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IMPLICATIONS

Taken together, the ten facts have implications for developing and implementing policy interventions to unlock the potential of land systems to help realize just and sustainable development.

These implications are not intended as a policy agenda but rather as core principles that actors ranging from decision makers and land system co-designers to the public, business community, and civil society, can leverage to make more sustainable land use decisions. Keeping these facts in mind will make it possible to build land-use practices, governance approaches and arrangements, strategic visions, and policy instruments that can rise to the challenge of sustainable, just, and effective land use globally.

Just Solutions to Land Challenges Acknowledge Multiple Perceptions, Beliefs, and Values, the Multiple Visions of Justice, and Power Differentials.

Failure to account for the different ways that distinct groups express their values and notions of justice results in some stakeholders perceiving interventions as unfair or ineffective. Frequently a policy or implementation effort, no matter how well-intentioned, may reproduce the effects and linkages that keep power imbalances in place.

Scientists and policy makers need to explicitly ask whose beliefs and values are being put forward or marginalized, and actively seek to understand the values of those whose voices are infrequently heard. Solutions and decision-making processes should go beyond those who hold formal rights

on the land, or directly benefit from it, to include all those with a stake and who derive benefits.

Transformative change operates not only by fostering desired pathways but also by weakening the forces that resist change.

Conflicts can be shaped into opportunities for transformational change, whether through governance strategies, new pathways for collaboration, or by applying multiple forms of justice to link groups, timeframes, and geographic distances.

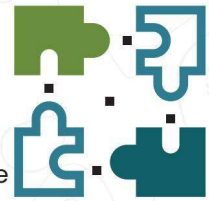


Solutions Are More Successful When They Are Contextual and Adaptive, Avoiding Silver Bullets or “One-Size-Fits-All” Panaceas.

The complexity of land systems means that adaptive governance is needed to adjust to unpredicted changes and evolving goals. Such strategies build on monitoring systems, regularly updated scenarios and learning, and flexible institutions that foster human agency. They can be supported by land system science research to identify key mechanisms and their conditions. This contrasts with approaches that focus on identifying single solutions that are applied across a wide set of contexts, or optimal solutions to maximize single benefits from a given area of land. Moreover, as new global actors and land uses continuously emerge, solutions are often imperfect and transient.

High-level, universal goals (for instance the SDGs, Paris Climate Agreement, Aichi Biodiversity

Targets) are crucial to mobilize efforts toward sustainability. But solutions that work in a given context can be a failure in others; for example intensification to reduce natural habitat conversion can be successful in certain contexts but nevertheless lead to land use expansion in others. Or, such single-context solutions can fail to achieve the balance of benefits desired by stakeholders. Diverse governance interventions are needed, from local to global, finding the balance between developing solutions that are context-sensitive and tackling systemic interactions across time, place, and sectors.



Governance of Land Systems Is More Effective When Considering Spillovers across Spatial and Temporal Scales.

Instead of focusing only on the local, direct land footprint decisions should be based on their overall expected impacts at broader spatial scales. Land use decisions should take into account the potentially large effects, “spillovers,” of opening a new road, allowing mining operations, densifying settlements, or intensifying agriculture.

New forms of public–private “polycentric” governance are needed that can work across jurisdictional boundaries and bridge distant regions. In such situations many formally-independent centers of decision-making---such as nation-states, local communities, nongovernmental organizations and transnational companies---make decisions together.

Effectiveness requires novel governance arrangements such as those proposed to steer urbanization and land change, the behavior of transnational corporations, supply chains, trade agreements, and distant linkages more broadly. While these approaches bring new sovereignty and legitimacy challenges, researchers are working to understand which policies and constellations of arrangements best support effective environmental governance.



IMPLICATIONS



Policies and Management That Prevent Undesired, Irreversible Impacts Bring More Overall Benefits than Trying to Restore Land Afterward.



The mitigation hierarchy in biodiversity conservation and land degradation requires implementing actions in the following order of priority: 1) avoid, 2) minimize, 3) restore or remediate, 4) offset environmental impacts of activities and land use. The aim is to prevent undesired “lock-ins,” that is, decisions that limit choices in the future.

Changes that are largely irreversible or create path dependence like urbanization have to be carefully planned to target land on which they can bring the largest benefits (and least harm), accounting for long-term effects.

Values and perceptions of land evolve over time, so governance interventions should seek to maintain a wide choice of possible future land uses.

IMPLICATIONS



Land-Use Decisions That Foster Synergies Are Important but Need to Be Combined with Mitigating Unavoidable Trade-Offs and Managing Demand.

Globally, there is room for improvement in balancing multiple trade-offs that deliver a broader set of benefits to human societies. Messy, regularly-renegotiated compromises, which aim for acceptable balance among different people or goals, are more likely to endure than optimizations that inevitably become outdated when priorities, or the social-ecological systems themselves, change.

Further, even land that appears “unmanaged” has importance for human societies and Earth system dynamics. The absence of formal, institutionalized, or visible management on these lands is, de facto, a management decision. Its implied trade-offs should be acknowledged in decision-making processes.

Ultimately, there is a need for more effective approaches for managing the demand and consumption of benefits that land systems provide

to people. Not all trade-offs can be addressed by managing the supply side of land systems, and there is a need for more effective approaches for managing the demand and consumption of benefits that land systems provide to people.

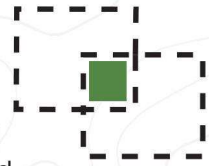


To Avoid Reinforcing Inequalities, Governance Interventions Need to Explicitly Address Inequalities and Acknowledge Unclear Land Tenure.

Distribution of benefits and dis-benefits is often linked to the effectiveness of interventions. Meta-analysis of evidence suggests that positive conservation outcomes, for instance, are more likely to occur with interventions that address equity. When approaches fit into, rather than challenge, existing social relations that govern resource access, they tend to be blunt instruments, failing to address underlying inequities in decision-making and how benefits or harms are distributed.

Across a spectrum of approaches and possible outcomes, the key finding for policy is that if the sole metric is effectiveness in terms of increasing the amount of products or services outputs, it is likely to affect equity, whether intentional or not. Land formalization, or enhancing land tenure security, can play an important role. But if this process is not

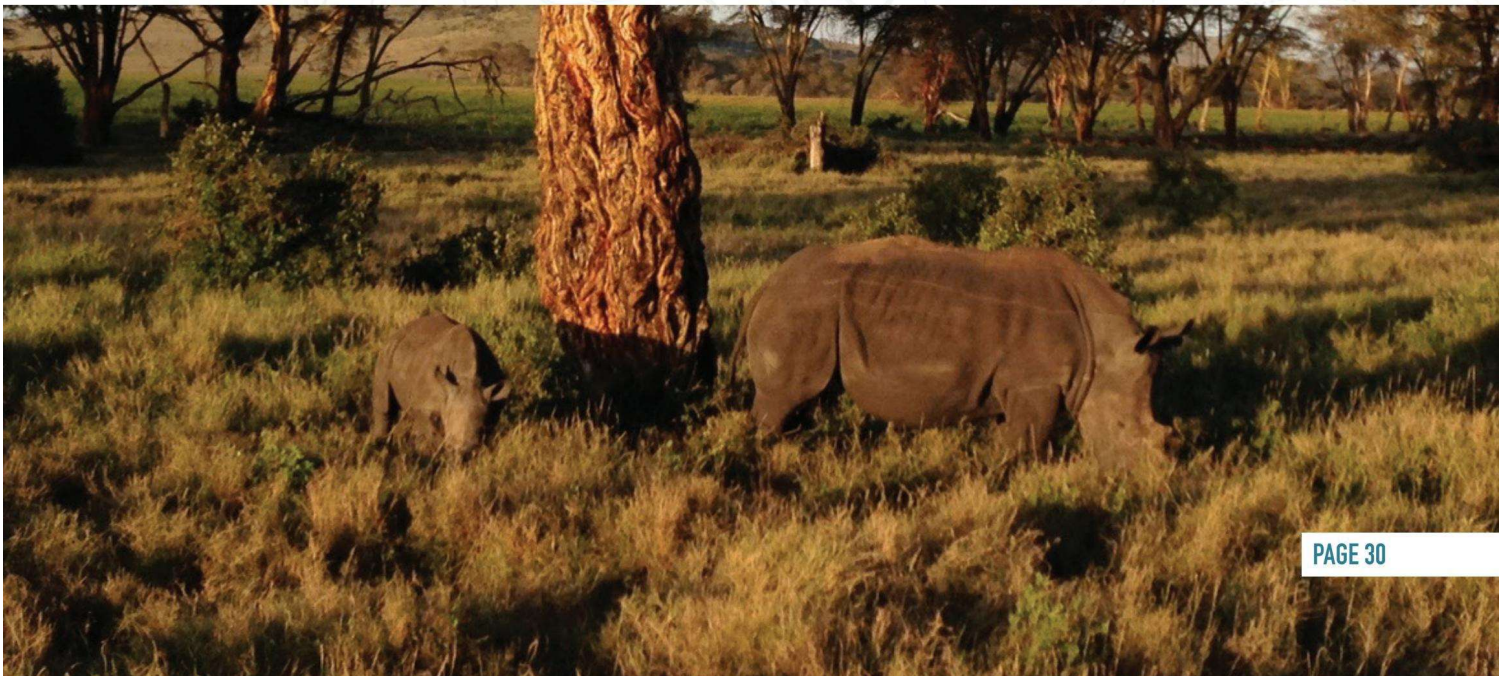
coordinated with other policies it can also induce land degradation, deforestation, or land concentration. Tenure formalization alone is not a panacea and needs to be combined with other interventions.



Effective land tenure and land registration policies can build on existing local institutions and other interventions, including redistributive land policies and agrarian reform; land market regulations; land taxes, in particular for large tracts of land left unproductive; anti-eviction and tenancy laws; mechanisms to increase accountability of companies and investors; mechanisms to foster collective and women's land rights; and mechanisms to foster broader transformations of food systems.

GOVERNANCE CAN BE IMPROVED BY

- 1 acknowledging clear and overlapping and contested land tenure,
- 2 identifying and targeting the actors that can enact land-use changes, and
- 3 enhancing local institutions and transparency and downward accountability of higher-level institutions.



Achieving sustainability through land systems is challenging precisely because land systems have multiple meanings and values and complex dynamics result in distant and sometimes irreversible impacts. We live on a used planet where trade-offs are prevalent, claims to land use are overlapping and contested, and benefits from land are unequally distributed.

These facts do not provide simple answers to current land-related challenges. But by identifying essential land system knowledge as a common ground, the facts are useful for any interventions that involve land for whatever reason: conservation, infrastructure development, agriculture, and other uses. Taking account of these facts can help avoid conflicts in implementation. By discerning trade-offs, explicitly addressing overlapping and contested claims, acknowledging unequal distribution of benefits, and accounting for multiple, sometimes conflicting, visions of justice, land use decisions are more likely to be sustainable and equitable.

"Ten Facts on Land" was written not only to collect hard truths, but to support efforts that put science, people, and policy in meaningful and constructive conversation in order to successfully tackle our most difficult global challenges.

Avoiding irreversible negative impacts is always preferable, but beyond this, progressing toward sustainability through land use is often about negotiating fair and acceptable trade-offs and compensations, and managing changing, complex conditions, rather than about achieving a single, optimal outcome, or stable peace among actors.

Acknowledging these facts and their implications can help much-needed conversations across diverse communities, building more solid foundations and shaping critical decisions and actions on land use and sustainability.



BRIDGING SCIENCE, POLICY, AND PRACTICE





GLOSSARY

AICHI TARGETS: 20 global policy goals aimed at protecting and conserving biodiversity, laid out in a 2010 strategic plan by the Convention on Biological Diversity

BASELINES: a starting point measurement, used for comparison and to establish or understand impacts

BIOCULTURAL: the combination of biological and cultural factors that affect human behavior

BONN CHALLENGE: global goal to bring 150 million hectares of degraded and deforested landscapes into restoration by 2020 and 350 million hectares by 2030

CBD OR CONVENTION ON BIOLOGICAL DIVERSITY: multilateral treaty dedicated to promoting sustainable development, steered by the United Nations and signed by 150 government leaders at the 1992 Rio Earth Summit

DIS-BENEFITS: Something that is a disadvantage or has a detrimental effect; a drawback

DISPLACEMENT (OF LAND USE): Typically, a geographic shift of land use from one place to another; more broadly, a separation between consumption and production of a material good

EARTH SYSTEM: Earth's interacting processes, including physical (the land, oceans, atmosphere and poles); also the planet's natural cycles and deep processes (the carbon, water, nitrogen, phosphorus, sulfur and other cycles). And human social and economic systems, which are now embedded in the other processes

ECOSYSTEM BENEFITS: the wide-ranging benefits to humans provided by the natural environment, for instance clean air, fresh water, and food

ECOSYSTEM SERVICES: the broader term for the many benefits people obtain from ecosystems, not just directly to humans but to our environmental conditions, e.g., through pollination, waste decomposition, etc. Popularized by the Millennium Ecosystem Assessment (MES). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) now subsumes this under the broader term of "nature's contributions to people"

INDIRECT LAND USE CHANGE: A form of spillover, where land use change in one place is caused by land use change in another place

IPLC: Indigenous peoples and local communities (IPLCs) are, typically, ethnic groups who are descended from and identify with the original inhabitants of a given region, in contrast to groups that have settled, occupied, or colonized the area more recently

LAND SYSTEM SCIENCE: studies the past, current, and projected state and dynamics of land use

LAND TENURE: the relationship, whether legally or customarily defined, among people, as individuals or groups, with respect to land

LEAKAGE: A form of land use spillover, where the spillover reduces the overall effectiveness of an environmental policy intervention

LOCK-INS: a situation where initial conditions and path dependence act to inhibit change and to maintain the system in its current state (including through negative feedbacks)

MITIGATION HIERARCHY: a widely used framework to guide activities toward limiting negative environmental impacts, such as on biodiversity or soils, used in various contexts including industrial sectors such as mining, energy, and manufacturing

OPTION VALUE: the value of having a more diverse set of options in the future

PATH DEPENDENCE: A situation or process in which the current state is dependent less on current conditions than a specific sequence of past actions

POLYCENTRIC GOVERNANCE: a system in which multiple governing bodies interact to make and enforce rules within a specific policy arena or location



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REBOUND EFFECT: In general, the reduction in expected gains from new technologies, because of behavioral or other systemic responses. In land use, a rebound effect is thus a form of spillover where adoption of intensifying practices stimulates land-use expansion

SDGS: or Sustainable Development Goals; were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity

SILVER BULLETS: a quick solution to a difficult problem

SPILLOVERS (IN LAND USE): a process by which land-use changes or direct interventions in land use (e.g., policy, program, new technologies) in one place have impacts on land use in another place

SYSTEMIC INTERACTION: interactions between components of a system, here with land systems being seen as “social-ecological systems” where human societies and environmental components interact, often in multiple ways at once

TELECOUPLING: socioeconomic and environmental interactions between distant coupled human and natural systems

TRADE-OFF: a balance achieved between two or more desirable but incompatible features; a compromise

WICKED PROBLEMS: Problems that are seemingly intractable and subject to multiple interpretations, typically characterized by the elusiveness of a final resolution, the absence of a definitive test for a solution, and the absence of generalizable solution that applies in all cases

WORKING LANDSCAPES: the landscapes of farmlands, forests, and rangelands that are managed by humans to produce food, water, fiber, fuel, and forest products

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Global Land Programme (GLP), a global research network of Future Earth, is an interdisciplinary community of science and practice fostering the study of land systems and the co-design of solutions for global sustainability. GLP convened top land systems scientists from around the globe to synthesize the knowledge from this field of study and align scientific research with existing efforts to solve our world's greatest land use challenges. The 10 Facts on Land Systems for Sustainability offers ideas and inspiration for how to craft land use policy that will lead to more just and sustainable outcomes for people and our planet.

