



AGRICULTURAL LAND USE PLANNING FOR ACHIEVING SUSTAINABILITY IN FOOD PRODUCTION

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Land use planning is the systematic assessment of land and water potential, alternatives for land use and socio-economic conditions to select and adopt the best land use options (Hurni 1997). Agricultural land use planning is a systematic approach for managing and allocating land resources for agricultural purposes. It takes into consideration the current state of agricultural land, identifying potential uses and constraints, and developing strategies to optimize productivity while minimizing negative environmental impacts. It involves evaluating the quality, fertility, and suitability of the land for different types of crops or livestock. Factors such as soil type, topography, climate, and water availability are considered. Based on the assessment, different land use options are identified, including crop cultivation, livestock grazing, agroforestry, or conservation measures like reforestation or wetland preservation by taking into consideration the socio-economic factors such as market demand, infrastructure availability, and land tenure systems. By carefully managing land resources and balancing competing interests, land use planning contributes to the long-term viability of agriculture and the overall well-being of society.

LAND USE PLANNING: A PATH TOWARDS SUSTAINABILITY

Land use planning helps allocate land resources efficiently, considering factors such as soil quality, topography, water availability, and biodiversity. By identifying suitable areas for different uses (Figure 1) like agriculture, urban development, conservation, and industry, planners can minimize resource conflicts and ensure sustainable utilization of land (Metternicht et al. 2017). Sustainable land use planning aims to conserve ecosystems and services they provide (e.g., clean water and air, habitat, Carbon (C) sequestration). Efficient land use planning supports economic development while minimizing negative environmental impacts. By guiding investment in infrastructure, industry, and tourism to appropriate locations, planners can stimulate economic growth, create job opportunities, and enhance the quality of life for communities without compromising environmental sustainability (De Wrachien, 2023). Agriculture is a fundamental component of land use planning, and sustainable agricultural practices are essential for food security.



By prioritizing the protection of prime agricultural lands, promoting diversified farming systems, and supporting smallholder farmers, planners can ensure a stable and resilient food supply for present and future generations. As land use planning plays a crucial role in climate change adaptation and mitigation promotion of afforestation, agroforestry, and sustainable land management can enhance C sequestration, reduce greenhouse gas emissions, and build resilience to climate change impacts like floods, landslides, and wildfires. By mapping hazard-prone areas, enforcing building codes, and implementing nature-based solutions, planners can reduce the vulnerability, enhance resilience, and protect communities and ecosystems from natural disasters. Thus, land use planning serves as a powerful tool to achieve sustainability by balancing economic development, environmental conservation, and social equity (De Wrachien, 2003). By integrating principles of sustainability into land use decisions, planners can create resilient, inclusive, and livable communities while safeguarding natural resources for future generations.

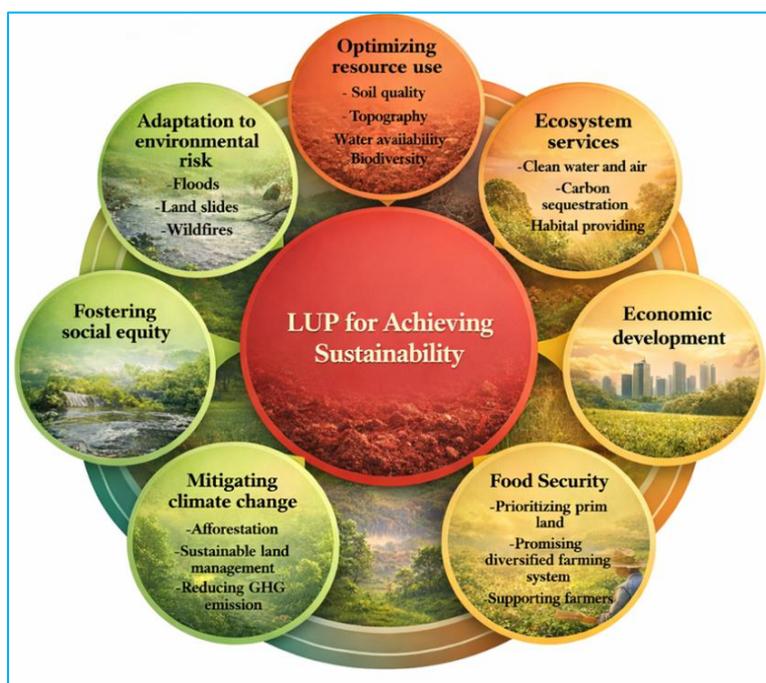


Figure 1. Land Use Planning as a Framework for Achieving Sustainability

NEED FOR AGRICULTURAL LAND USE PLANNING

Resource Optimization: It enables efficient use of existing land resources by identifying the most suitable areas for various agricultural activities based on soil quality, topography, water availability, climate conditions, and market demand

Sustainability: Effective land use planning supports sustainable agricultural practices by reducing soil degradation, erosion, and depletion of natural resources. It promotes the adoption of farming methods that conserve soil fertility, enhance biodiversity, and minimize negative environmental impacts.

Economic Development: Precise agricultural land use planning backs rural economic development by increasing crop productivity, new employment opportunities, and supporting local industries like food processing and agri-based small-scale business units. That in turn, enables infrastructure development in rural areas, and facilitate more investment in agricultural research.

Environmental Protection: The right land use planning initiatives help to protect natural habitats, conserve biodiversity, and preserve ecosystem services such as water regulation, C sequestration, and pollination. They include measures to minimize the negative impacts of agriculture on air & water, mitigate climate change, and enhance the resilience of agroecosystems to the extreme weather events

Conflict Resolution: Sometimes, conflicts arise among agricultural different stakeholders like farmers, environmental activists, indigenous communities and city developers over land use. Land use planning provides a framework for conflict resolution in these situations, enabling participatory decision-making, stakeholder consultation, and land zoning regulations.

Risk Management: By identifying areas prone to natural hazards such as floods, drought, or wildfires, land use planning helps to manage risks and improve disaster readiness. It involves implementing land use practices that mitigate the impacts of climate-related risks and ensure the resilience of farming systems to potential shocks.



APPROACHES FOR SUSTAINABLE AGRICULTURAL LAND USE PLANNING

Sustainable agricultural land use planning involves specific approaches (Figure 2) tailored to the unique challenges and opportunities of agricultural landscapes (Verheye, 2004). Some of the key approaches are outlined below.

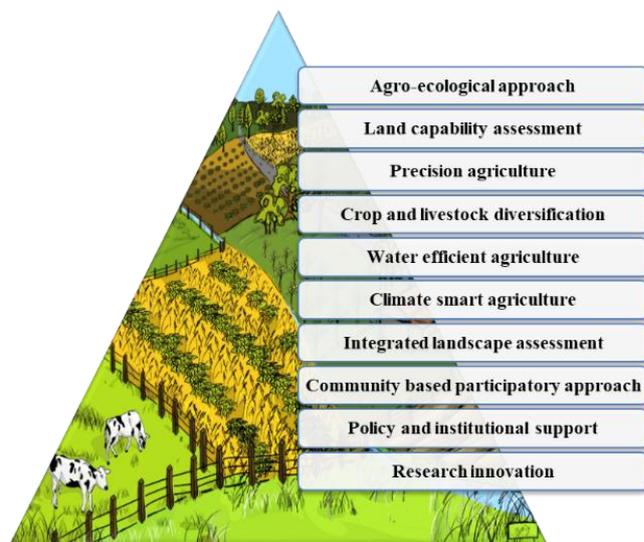


Figure 2. Approaches for Sustainable land Use Planning

Agro-ecological Approach: This approach integrates ecological principles into agricultural land use planning, emphasizing the importance of biodiversity, soil health, water conservation, and ecosystem services in sustainable farming systems. Agro-ecological practices, such as crop rotation, agroforestry, cover cropping, and integrated pest management, promote resilience, productivity, and environmental sustainability

Land Capability Assessment: Assessing the capability of land for different agricultural uses based on factors such as soil quality, topography, climate conditions, and water availability helps identify suitable land for various crops, livestock, and agroforestry systems. Land capability assessments inform land use decisions, zoning regulations, and conservation priorities to optimize agricultural productivity while minimizing environmental impacts.

Precision Agriculture: Precision agriculture utilizes technology, data analytics, and spatial analysis to optimize input use, improve crop yields, and reduce environmental footprints. Techniques such as GPS-guided machinery, remote sensing, variable rate application, and sensor-based monitoring enable farmers to manage agricultural resources more efficiently, conserve soil and water, and minimize chemical inputs

Crop & Livestock Diversification: Crop diversification through multi-layer cropping, intercropping and crop rotations, and integration of livestock into agriculture, promote enhancing biodiversity, soil fertility, and crop resilience to biotic stress. Crop and livestock diversification also helps to reduce the production risks, improve the stability of farm income, and contribute to food and nutritional security.

Water-Efficient Agriculture: The increasing water scarcity in farming and competition to access available water resources highlights the need for adopting water-efficient farming practices through agricultural land use planning. Techniques such as drip irrigation, rainwater harvesting, soil moisture monitoring, and water recycling optimize water use efficiency, reduce water wastage, and mitigate the impacts of drought on agricultural production.

Climate-Smart Agriculture (CSA): CSA equips farmers to adapt to climate change, mitigate greenhouse gas emissions, and enhance C sequestration in farm fields. Strategies such as agroforestry, conservation tillage, use of improved crop varieties, and climate-resilient farming systems help in building resilient agroecosystems, reduce vulnerability to climate-related risks, and contribute to climate change mitigation efforts.

Integrated Land Management: This approach considers the interactions between agriculture, forestry, water management, biodiversity conservation, and socio-economic activities within a landscape. by adopting a landscape-scale perspective, planners can identify trade-offs, synergies, and co-benefits among different land uses, promote landscape connectivity, and enhance ecosystem services while meeting the agricultural production goals



Community-Based Planning and Participatory Approaches: Engaging farmers, local communities, and other stakeholders in the planning process foster ownership, collaboration, and knowledge sharing. Also, participatory approaches ensure that land use plans actually reflect local needs, preferences, and traditional knowledge, leading to more context-specific and socially equitable outcomes.

Policy and Institutional Support: Supportive policies, incentives, regulations, and institutional frameworks play a crucial role in promoting sustainable agricultural land use planning. Government can provide subsidies for motivate farmers to adopt sustainable farming practices, establish land use regulations that protect prime agricultural lands, invest in agricultural extension services, and facilitate access to credit, markets, and technology for smallholder farmers.

Research and Innovation: Continuous research, innovation, and knowledge sharing are essential for advancing sustainable agricultural land use planning. Agricultural research institutions, extension agencies, NGOs and other private partners can conduct research on sustainable farming practices, disseminate best practices, and provide technical assistance to farmers, policymakers, and land managers.

Through integrating all these approaches, sustainable agricultural land use planning can enhance agricultural productivity, conserve natural resources, improve rural livelihoods, and contribute to food security, while safeguarding the environment for future generations.

LAND USE PLANNING AS AN AID TO ACHIEVE LAND DEGRADATION NEUTRALITY

Land use planning can indeed serve as a powerful tool to help achieve land degradation neutrality (LDN), which is a key target under the United Nations' Sustainable Development Goals (SDGs). LDN aims to maintain or improve the condition of land resources, particularly soil, over time, thereby ensuring the sustainable use of land and ecosystems. Here's how land use planning can aid in achieving LDN:

- Identifying Degradation Hotspots
- Setting Land Use Priorities
- Integrating Conservation Practices Promoting Sustainable Land Use Practices
- Incorporating Climate Change Adaptation
- Community Participation and Stakeholder Engagement
- Monitoring and Evaluation

SUMMARY

The sustainable agricultural land use planning requires the participation of various stakeholders, including governments, local communities, the private sector, and civil society. Land Use Planning is not just a tool for spatial organization but a strategic approach to achieving sustainable development. Land use planning ensures that land resources are used efficiently and responsibly, contributing to a sustainable future for all. These will be helpful in environmental stewardship, economic development, and social equity.

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