

## Understanding Ecosystem Services for a Sustainable Living

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### ABSTRACT

*Ecosystem Services form the basis of natural as well as man-made systems like, agriculture. Though the ecosystem services play a pivotal role in sustaining the lives and livelihood of the living beings, yet they are not well represented in the government policies and agendas. There are direct and indirect drivers that impact the ecosystem. In the present scenario, it is important to understand the interactions and interdependencies between the various drivers, so that ecosystem-based adaptation strategies can be implemented for sustainable agricultural practices, urbanization and livelihood. Ecosystem services forms the core of a water-energy-land-food nexus, which is significant in attaining Sustainable Development Goals. A better understanding of synergies and trade-offs across sectors will help in the integration of planning, valuation and management of ecosystem services.*

**Keynotes:** Ecosystem Services, sustain human life, Sustainable Development Goals.

### INTRODUCTION

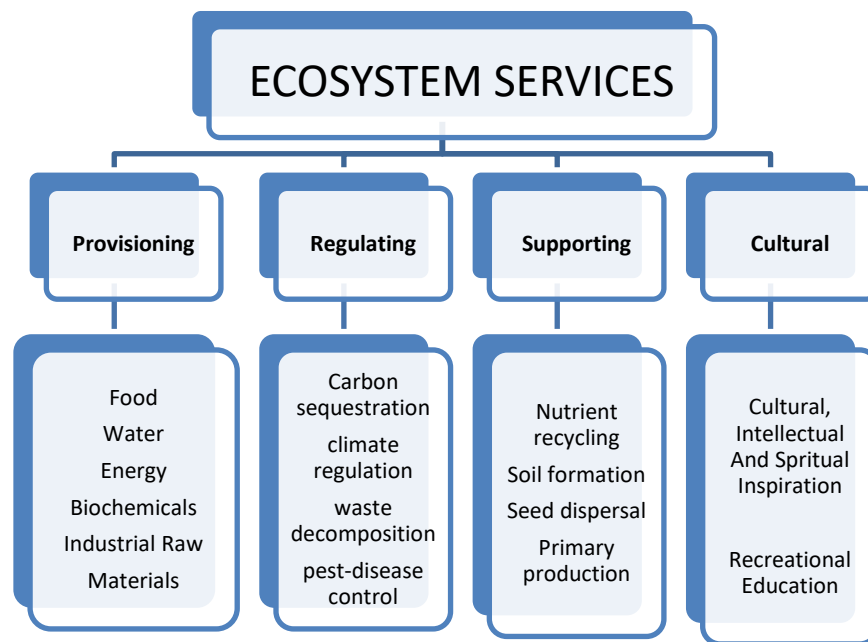
Ecosystem sustain human life by providing four types of ecosystem services, viz. provisioning service, regulating service, supporting service and cultural service. Due to the ignorance of their value to human well being and lack of socioeconomic valuation that encourage individuals/government to invest in maintaining them, makes the ecosystem more vulnerable towards exploitation and deterioration. Engineered/Modified Ecosystem, from farmlands to cities, support and provide the

most important ecosystem services which are essential for human life. But these services are left outside the decision making in managing the agricultural and urban areas. This is due to the lack of knowledge and awareness of how ecosystem services are associated with these modified ecosystem (Sandhu & Wratten) The Millennium Ecosystem Assessment (2005), defines ecosystem services as the benefits people obtain from ecosystem.

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The ecosystem services can be classified as:



### The Ecosystem Service (ES) Framework:

The ES Approach is one that integrates ecological, social and economic dimension of natural resource management (Cork et al., 2007). It was first developed by the Convention on Biological Diversity (CBD) and was officially endorsed during the COP5 in 2000 in Nairobi, Kenya. Cork and colleagues (2007), hence described an ES Approach as the following;

1. It helps to identify and classify the benefits that people derive from ecosystems. It also includes market and non-market, use and non-use, tangible and nontangible benefits.
2. It also explains consumers and producers of ES for maintenance and improvement of ecosystem for human well being.
3. It helps to describe and communicate benefits derived from natural and modified ecosystems to a wide range of stakeholders.

Ecosystem based Adaptation, integrates biodiversity and ES into an overall adaptation strategy to help people to adapt to the adverse effects of, for example, climate change (Colls et al., 2009). Engineered systems are landscapes such as farmland and cities that are actively

modified to supply a particular set of ES. They are producers as well as consumers of different types of ES. Optimally managed engineered/modified/designed ecosystem can provide a range of important ES, for instance, more fresh water, cleaner air and greater food production as well as fewer floods and pollutants (Palmer et al., 2004).

### Agricultural Systems

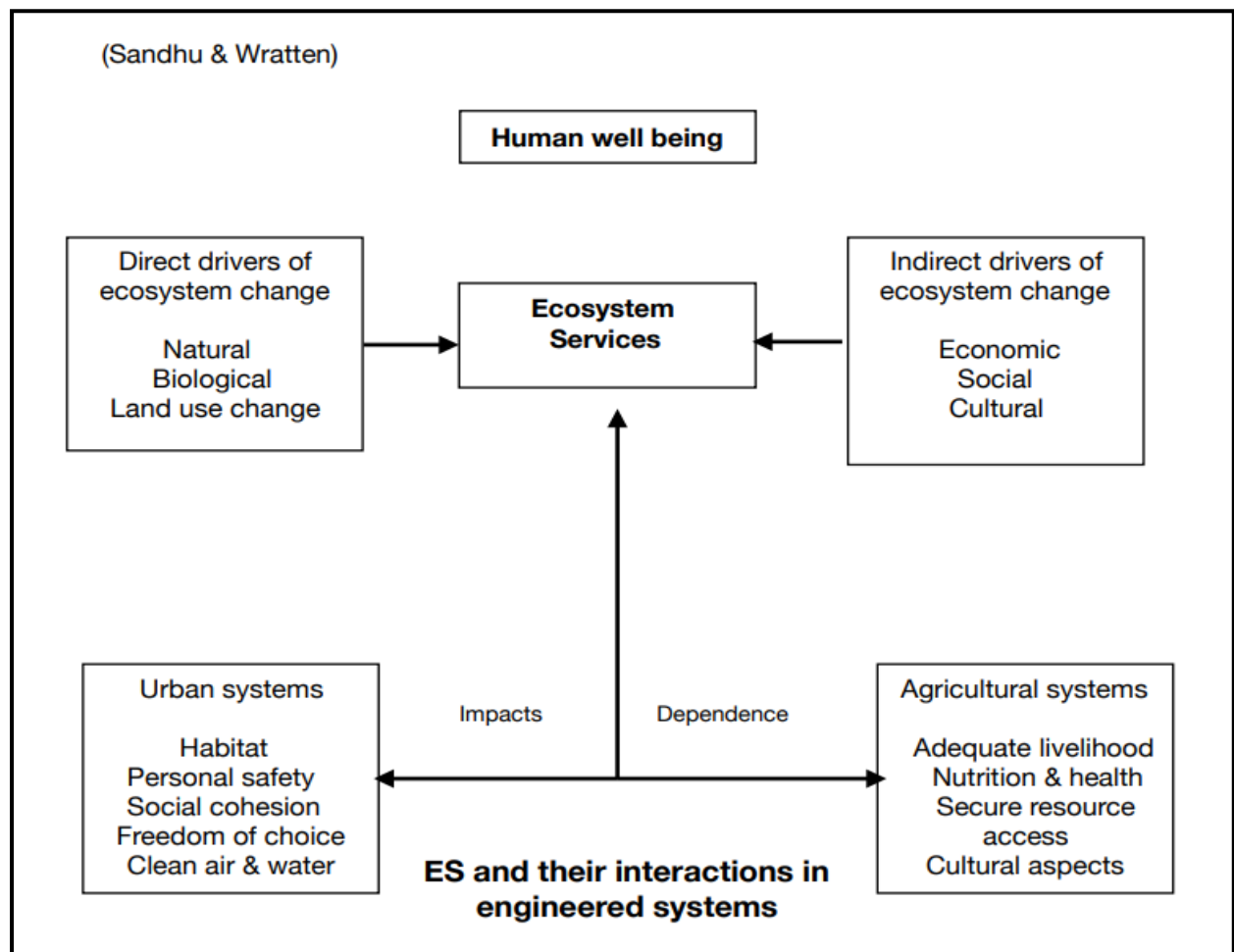
Agricultural land (farmland) comprises highly modified landscapes designed not only to generate food security but livelihood security as well. Farmers may use natural inputs (cow dung) or chemical inputs (fertilisers or pesticides) to produce food and fibre. A shift towards intensive agriculture no doubt has increased the production but has definitely led to pollution as well. The major drawback being that the longterm effect i.e. decreases in the ES goes unrecognised and unevaluated. It is now urgent that ES on farmlands be enhanced as part of global food policy because increasingly dysfunctional biomes and ecosystem are appearing and agriculture which largely created the problem, has become more intensive in its use of non-renewable resources, driven by the increasing

population. Continuing with the current energy intensive (Pimentel et al., 2005), wasteful (Vitousek et al., 2009), polluting and unsustainable agriculture with its associated problems, which are likely to be exacerbated by climate change, is not an option for future world food security and productivity.

**Urban Systems**

Urbanisation is one of the major drivers of ecosystem changes. Urban areas provide habitat for the human population. The urban growth is taking place at an unprecedented rate. However, the knowledge about ES is important for

maintaining the quality of cities and health of the people. Urban ecosystem have been neglected due to the lack of understanding of the complex processes involved, the lack of mechanism to govern them and the failure to incorporate ES into day to day decision making (Sandhu & Wratten). Urban systems are not self sufficient and functional and largely depend on surrounding ecosystem and ES. Even though urban areas are not a major producer of ES, but they can alter the supply of ES from a local to a global level.



In the present scenario, adaptation to climate change is critically important, especially for developing countries where large number of people depends on climate sensitive sectors like agriculture, forestry and fisheries, have limited resources & capacity, and live in climate-vulnerable

settings such as mountains and coastal areas (WRI, 2011).

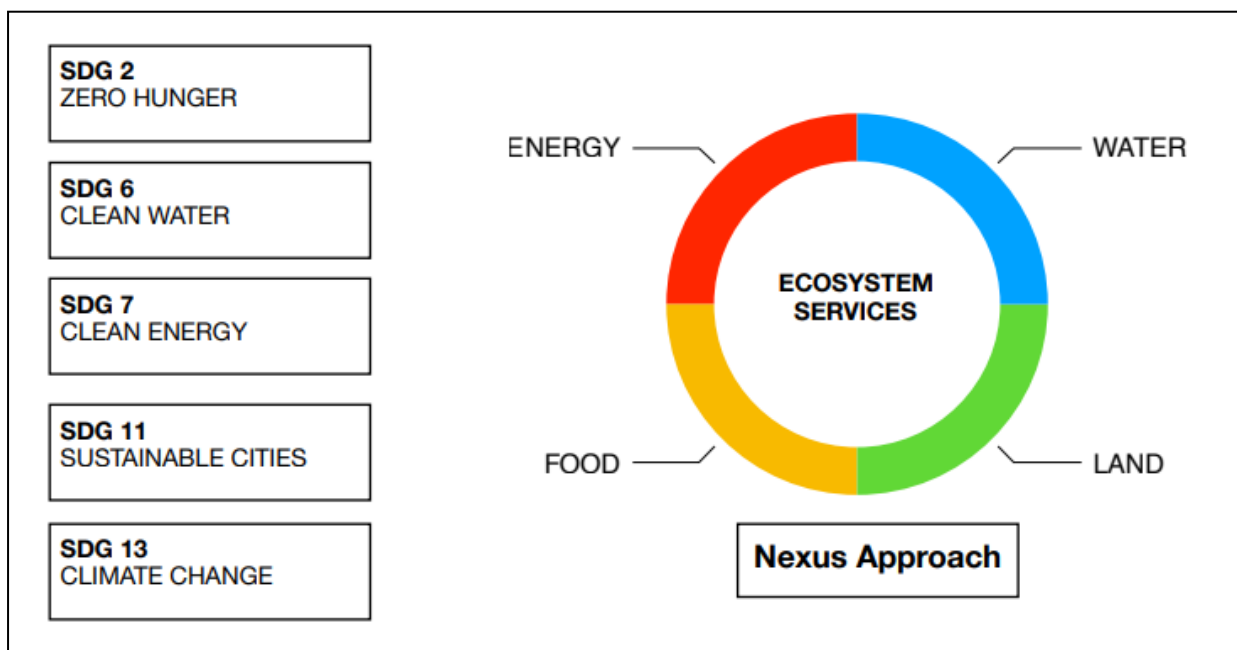
Although, interest in adaptation to climate change impacts and unplanned urban development has surged in recent years, the focus has remained sectoral in nature. Eriken et al. 2011, defines

sustainable adaptation as a set of actions that contribute to socially and environmentally sustainable development pathways, including social justice and environmental integrity. It considers the wider effects of adaptive responses on other groups, places and socio-ecological systems, with in the present and in the future.

Acknowledged at the Bonn 2011 Nexus Conference that integrated policies related to water, energy and food are required in the face of growing concerns over the future availability and sustainability of these resources (UNECE). Nexus approach in practical terms, presents a conceptual framework to better understand and systematically analyze the

interactions between the natural environment and human activities, and to work towards a more coordinated management and use of natural resources across sectors and scales. This can help us to identify and manage trade-offs and to build synergies through our responses, allowing for more integrated and cost effective planning, decision making, implementation, monitoring and evaluation (FAO).

The Sustainable Development Goals (SDGs), a collection of 17 global goals set by the United Nations General Assembly in 2015. They are the blueprint to achieve a better and more sustainable future for all.



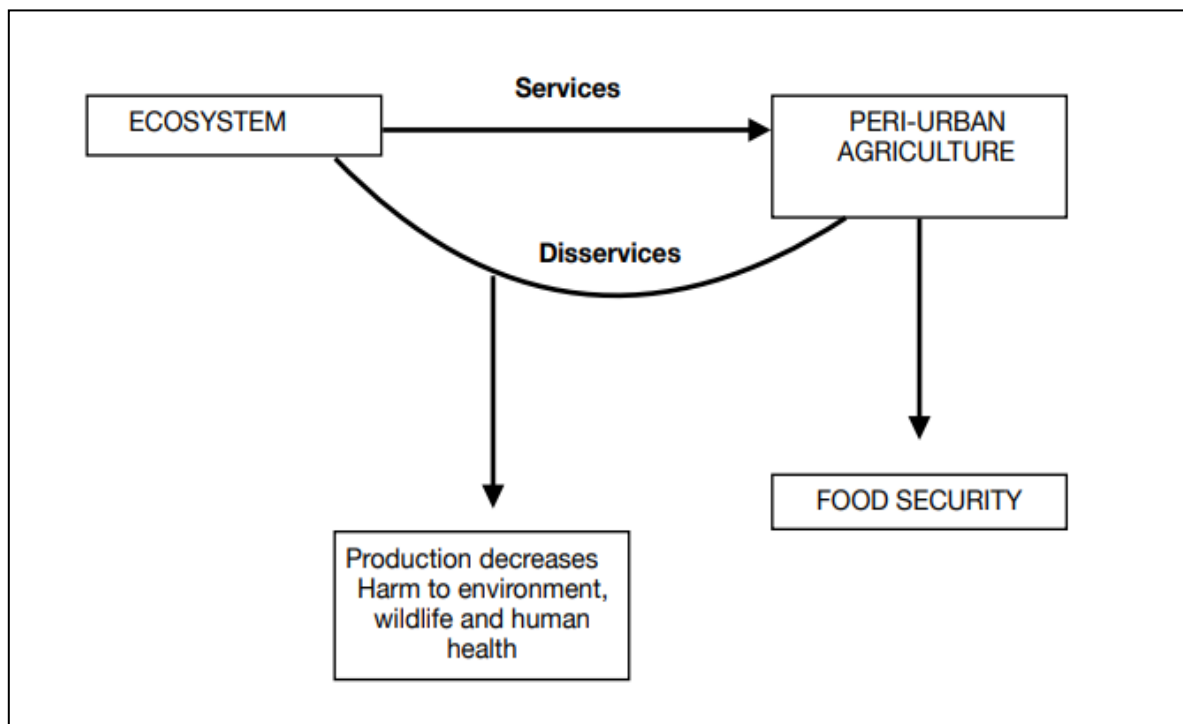
By understanding the interdependence of sub-systems (land, food, water, energy) within a system across space and time, would help focus on system efficiency rather than productivity of individual sector to provide integrated solutions. It would also promote economically rational decision making and efficient use of these resources in an environmentally responsible manner. In the current vulnerable engineered ecosystem, it is important to identify integrated policy solutions to minimize

trade-offs and maximize synergies across sectors and encourage mutually beneficial responses that enhance the potential for cooperation between and among all sectors and public-private partnership at multiple scales. The focus being, long term sustainability with limited environmental impacts.

Continuing with largely energy intense, wasteful, polluting and unsustainable agriculture is no longer a viable option for future world food security

and human well being. There is an urgent need to shift towards 'Landscape Benefits' that improves natural capital and ecosystem services (Sandhu et al., 2016). Peri-urban

may be a zone of smaller settlements, industrial areas and other urban land-uses within a matrix of functional agriculture (Ilsson et al., 2013).



ES are often presented as a static function of the vegetation, however natural ecosystems are dynamic and ignoring this dynamism increases the risk of altering the ecosystems capability to provide certain services in the future. The interplay between dynamics, its drivers and the supply of ES is important in areas where the local livelihoods are directly dependent on natural ecosystem. An all inclusive resource management plan that balances the tradeoff between ES and well being of people, is the need of the hour.

Traditionally, agro-ecosystems have been considered primarily as a source of provisioning services, but more recently their contributions to other types of ES have been recognised (MEA, 2005). Indeed, agricultural land use can be considered an intermediate stage in a human impact continuum between wilderness and urban ecosystems (Swinton et al., 2007). Influenced by human management, ecosystem processes within an

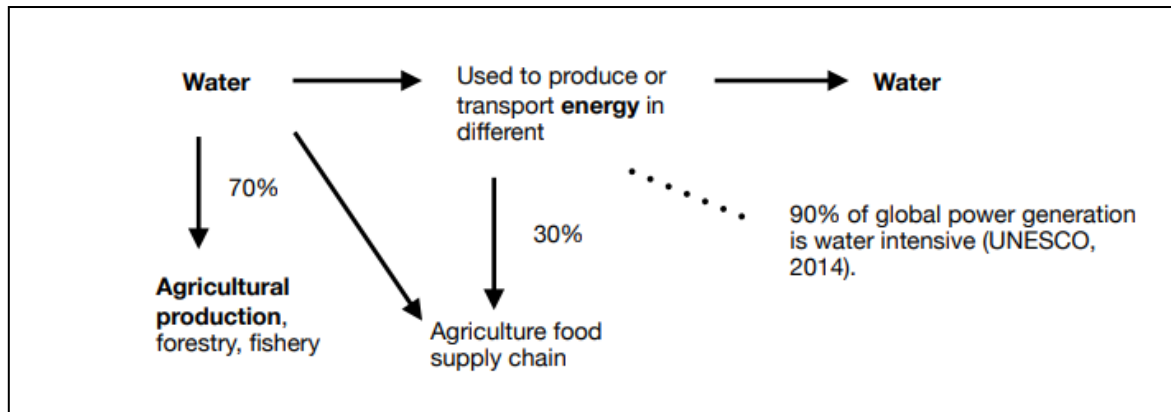
agricultural system can provide services that supports provisioning services and also influence the potential for 'disservices' (Zhang et al., 2007).

The ES produced by 'Peri-Urban Ecosystem' and through 'Peri-Urban Agriculture' (PUA) play significant roles in multiple aspects of urban sustainability ECOSYSTEM PERI-URBAN AGRICULTURE FOOD SECURITY Production decreases Harm to environment, wildlife and human health Services Disservices and resilience. Yet the ecosystem upon which these services depend are increasingly under threat and persistently overlooked in policy and planning. PUA is one of the activities most directly dependent upon the continuing functioning of ecosystem and there services they provide, such as, clean water, pollination and soil nutrient recycling (Jennings et al., 2015), whilst also itself contributing to multiple ES with

benefits for peri-urban communities and the wider urban population.

The Water-Food-Energy Nexus is central to sustainable development. Demand for all three is increasing, driven by a rising global population, rapid urbanisation,

changing diets and economic growth. The inextricable linkages between these critical domains require a suitable integrated approach to ensuring water and food security and sustainable agriculture and energy production worldwide (UN).



While almost 800 million people are currently hungry, by 2050 global food production would need to increase by 50% to feed the more than 9 billion people projected who live on our planet (FAO/UNICEF/WHO, 2017).

Water security, food security and energy security - are inextricably linked and that action in one area more often than not have impacts in one or both of the others.

FAO defines food security as the state in which all people at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active, healthy life (FAO, 1996).

UN Water (2013) defines water security as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well being and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.

IEA defines energy security as the uninterrupted availability of energy sources at an affordable price.

Current farming and food systems are facing multiple challenges and unsustainable changes like climate change, environmental pollution, bio-diversity loss and deteriorating ES (MEA, 2005). The different agricultural practices in PUA can either undermine or enhance ES. However, rapid unplanned urbanisation is threatening peri-urban agricultural livelihoods and the ecosystem that peri-urban production systems rely upon. A direct result of which is the loss of cities' resilience to

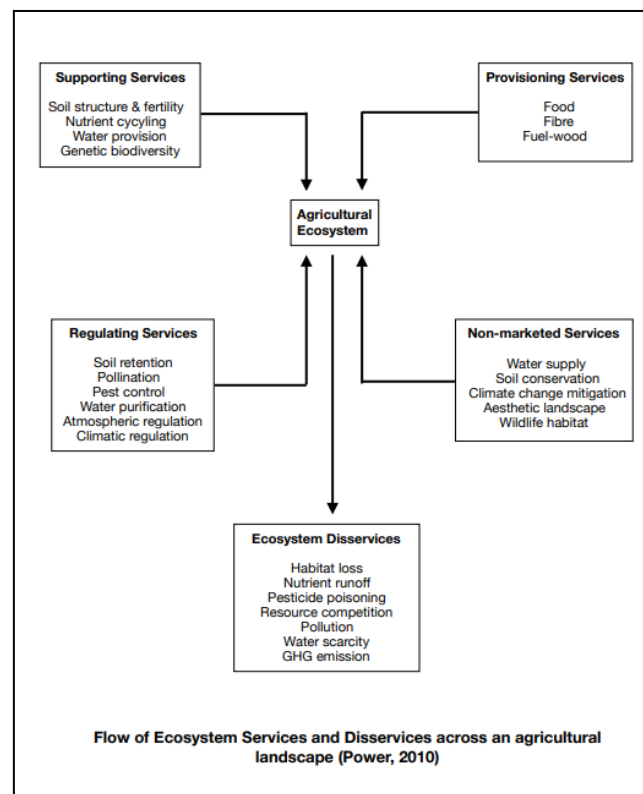
extreme weather conditions, rising temperature, water security and other food system shocks (ESPA, 2017). Despite this, the importance of PUA and the threats to PUA from urban sprawl and pollution are often unrecognized (Marshall & Randhawa). PUA is fundamentally dependent on ES as the foundation of agricultural sustainability and urban food security. Its capacity to provide multiple goods and services in addition to its primary crop production function is being

affected. The key roles played by PUA are urban food provision, livelihood development, provision of ES and poverty alleviation. But PUA is simultaneously under pressure due to inappropriate planning, pollution and resource competition.

People are fighting for survival, money, security and luxury. It is important to demonstrate ecosystem benefits and costs in a PUA system. The community doesn't realize that with the trend, the ecosystem disservices will surpass the ecosystem services and then the production will ultimately decrease. A better understanding of ecological processes and their economic contribution in agro-ecosystem can help develop protocols which don't require major farming system changes, but enhance ES by returning selective functional agricultural biodiversity to agriculture.

The SDG-11 "Make Cities Inclusive, Safe, Resilient & Sustainable" is fundamental for urban development worldwide. Common urban challenges in a developing nation includes congestion, lack of funds to

provide basic services, a shortage of adequate housing, declining infrastructure and rising pollution. To end poverty and build resilience of the poor and those in vulnerable situations (SDG-1), its important to ensure sustainable food production system (SDG-2), water sustainability including water quality, water use efficiency, integrated water resource management & restoration of water related ecosystems (SDG-6) and sustainable clean energy (SDG-7). Urban areas are core to the competition for and degradation of natural resources, which results in the deterioration of ecosystem and ES in the peri-urban areas. A key challenge of Ecosystem Management is determining how to manage multiple ES across landscape. The relationships among multiple ES are better identified and assessed by integrated socio-ecological approaches. Peri urban areas offer large opportunities to improve livelihoods and make people benefit from ES. Managing relationships among ES can strengthen ecosystem resilience, enhance the provision of multiple ES and help avoid catastrophic shifts in ES provision.



The continued supply of ecosystem goods and services is vital for the growth and development of agriculture and cities. The sustainable use of these ES is important to maintain the water-energy-food nexus. The expansion in the demand and supply of the marketable ES has led to the deterioration of the unmarketable ES which are equally important in the overall functioning of the natural as well as engineered ecosystem. Demands of the rising population in the urban areas to maintain and enhance their lifestyle have resulted in the degradation of valuable ES. Thus, it is important to recognise and understand the role of ES in sustaining the economic wealth of individual, societies and nation. This will help to achieve food security, livelihood opportunities, poverty alleviation and environmental stability. Integrating planning, valuation and management of ecosystem services in the peri urban areas will help achieve Sustainable Development Goals.

#### REFERENCES

- Colls, A., Ash, N., & Ikkalal, N. (2009). Ecosystem based Adaptation: a natural response to climate change. IUCN report.
- Cork, S., Stoncham, G., & Lowe, K. (2007). Ecosystem Service and Australian Natural Resource Management Future.
- Eriksen, S., Aldunce, P., Bahinipati, C. S., Martins, R. D., Molefe, J. I., Nhemachena, C., & Ulsrud, K. (2011). When not every response to climate change is a good one: identifying principles for sustainable adaptation.
- Ecosystem Service for Poverty Alleviation (ESPA) (2017). Why peri-urban ecosystem services matter for urban policy.
- Food and Agriculture Organisation of the United Nation (FAO) (2014). The water-energy-food nexus - a new approach in support of food security and sustainable agriculture.
- Foley, J. A., deFries, R., & Asner, G. P. (2005). Global consequences of land use.
- Sandhu, H., Wratten, S., Porter, J. R., Costanza, R., Pretty, J., & Reganold, J. P. (2016). Mainstreaming ecosystem services into future farming.
- Sandhu, H., & Wratten, S. Ecosystem Services in Farmland & Cities. Book chapter - Ecosystem services in agricultural and urban landscape.
- Ilson, K., Pauliet, S., Bell, S., Aalbera, C., & Nielsen, T. (Eds) (2013). Peri-urban Futures: Scenarios and Models for land use change in Europe.
- Jennings, S., Cottee, J., Curtis, T., & Milles, S. (2015). Food in an urbanised world: the role of city region food systems in resilience and sustainable development.
- Marshall, F., & Randhawa, P. Forthcoming. Transforming rural urban relations and food security in India.
- Millennium Ecosystem Assessment (MEA, 2005). In ecosystem and human well being: biodiversity synthesis, World Resource Institute.
- Palmer, M., Bernhardt, E., & Chornesky, E. (2004). Ecology for a crowded planet.
- Pimental, D., & Wilson, A. (2004). World population, agriculture and malnutrition.
- Power, A. G. (2010). Ecosystem services and agriculture: tradeoffs and synergies.
- Swinton, S. M., Lupi, F., Robertson, G. P., & Hamilton, S. K. (2007). Ecosystem Services and agriculture: cultivating agricultural ecosystems for diverse benefits.
- United Nations Commission for Europe - Water Convention (UNECE, 2014). Water-food-energy-ecosystem nexus: reconciling different uses in transboundary river basin.

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World Resource Institute (WRI, 2011). Zhang, W., Ricketts, T. H., Kremen, C.,  
World resources 2010-11: Decision making in a changing climate - adaptation challenges and choices. Carney, K., & Swinton, S. M.  
Vitonsek, P. M., Naylor, R., & Crews, T. (2007). Ecosystem Services and  
(2009). Nutrient imbalances in disservices to agriculture.  
agricultural development.