NATIONAL OPEN UNIVERSITY OF NIGERIA

FACULTY OF HEALTH SCIENCES

COURSE CODE: EHS413

COURSE TITLE: URBAN PLANNING AND SUSTAINABLE DEVELOPMENT

COURSE GUIDE

EHS 413
URBAN PLANNING AND SUSTAINABLE DEVELOPMENT

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INTRODUCTION

The course **EHS 413 Urban Planning and Sustainable Development** is a three unit course with three modules and eight units. It is intended that the course will prepare students with the advanced skills and techniques of planning towards sustainable development. It is one of the core courses that incorporate the interdisciplinary of planning and sustainability in the study of the environment with emphasis in public policy development, law and the methods, theory, and the processes of planning and decision making. It prepares students to develop an area of special interest in a defined planning sub-discipline and that of sustainable urban societies.

EHS 413 emphasises innovative approaches to solving complex problems facing communities from the local to the global. It is designed in a way that it stresses progressive change leading towards equitable, healthful, liveable and sustainable urban communities with the emphasis on social and environmental justice, multiculturalism, diversity and under-served communities. The curriculum is designed with its three modules each to focus on one of the following key areas: urban planning; sustainable design; environmental science and policy. Following these, it is hoped that it will provide students with understanding of the linkages between urban and natural systems and the multidimensional problems in urban development and sustainable urban livelihood.

WHAT YOU WILL LEARN IN THIS COURSE

This course develops students towards the acquisition of both knowledge and skills that promote positive change in the environment and help create more liveable communities. Students will know about the challenges of city life and how to solve the complex problems of implementing shared vision in both natural settings and urban communities. It prepares students towards building a more equitable and sustainable society, and guides towards understanding the relevant laws and policies, and processes that guide community and environmental change.

COURSE AIM

The Course is aimed at acquainting students with the science of sustainable urban planning especially in a typical African environment.

COURSE OBJECTIVES

By the end of this course, you will be able to:

- introduced to the theoretical and interpretive views of human settlement from several disciplinary perspective
- acquainted with the history of the planning discipline and key theories of planning
- familiar with the legal, political and organisational context in which planning is pursued in, especially, Nigeria
- acquire tools and practical skills urban planners need in order to understand urban and regional trends and analyse planning problems.

WORKING THROUGH THIS COURSE

To successfully complete this course, you are required to read each study unit, read the textbooks materials provided by the National Open University of Nigeria. Reading the referenced materials can also be of great assistance. Each unit has self-assessment exercises which you are advised to do and at certain periods during the course you will be required to submit your assignment for the purpose of assessment. There will be a final examination at the end of the course. The course should take you about 17 weeks to complete. This course guide will provide you with all the components of the course how to go about studying and hour you should allocate your time to each unit so as to finish on time and successfully.

THE COURSE MATERIALS

The main components of the course are:

a. The Study Guide
b. Study Units
c. Reference/Further Reading
d. Assignments
e. Presentation Schedule

STUDY UNITS

The study units in this course are as follows:

Module 1 Urban Planning

Unit 1 Planning History and Theory
Unit 2 Urban Ecology and Regional Analysis
Unit 3 Urban Growth Analysis

Module 2 Sustainable Design

Unit 1 Principles of Urban Design
Unit 2 Sustainable Planning Framework

Module 3 Environmental Science and Policy

Unit 1 Land Use Policy
Unit 2 Science in the Policy Process
Unit 3 Energy, Planning and Built-Environment

There are activities related to the lecture in each unit which will help your progress and comprehension of the Unit. You are required to work on these exercises which together with the TMAs will enable you to achieve the objectives of each unit.

ASSIGNMENT FILE

There are two types of assessments in this course. First are the Tutor-Marked Assessments (TMAs); second is the written examination. In solving the question in the assignments, you are expected to apply the information, knowledge and experience acquired during the course. The assignments must be submitted to your facilitator for formal assessment in accordance with prescribed deadlines stated in the assignment files. The work you submit to your facilitator for assessment accounts for 30 percent of your total course mark. At the end of the course, you will be required to sit for a final examination of two-hour duration at your Study Centre. This final examination will account for the remaining 70 percent of your total course mark.

PRESENTATION SCHEDULE

There is a time-table prepared for the early and timely completion and submission of our Tutor-Marked Assessments (TMAs) as well as

attending the tutorial classes. You are required to submit all your assignments by the stipulated time and date. Avoid falling behind the deadline.

ASSESSMENT

There are three aspects to the assessment of this course. The first one is the self-assessment exercises. The second is the tutor-marked assignments and the third is the written examination or the examination to be taken at the end of the course. Do the exercises or activities in the unit by applying the information and knowledge you acquired during the course. The tutor-marked assignments must be submitted to your facilitator for formal assessment in accordance with the deadlines stated in the presentation schedule and the assignment file. The work submitted to your tutor for assessment will count for 30% of your total course work. At the end of this course, you have to sit for a final or end of course examination of about a three-hour duration which will count for 70 percent of your total course mark.

TUTOR-MARKED ASSIGNMENT

This is the continuous assessment component of this course and it accounts for 30% of the total score. You will be given four (4) TMAs by your facilitator to answer. Three of which must be answered before you are allowed to sit for the end of course examination. These answered assignments must be returned to your facilitator. You are expected to complete the assignments by using the information and material in your readings references and study units. Reading and researching into you references will give you a wider view point and give you a deeper understanding of the subject.

1. Make sure that each assignment reaches your facilitator on or before the deadline given in the presentation schedule and assignment file. If for any reason you are not able to complete your assignment, make sure you contact your facilitator before the assignment is due to discuss the possibility of an extension. Request for extension will not be granted after the due date unless in exceptional circumstances.

2. Make sure you revise the whole course content before sitting for the examination. The self-assessment activities and TMAs will be useful for this purposes and if you have any comment please bring them forward before the examination. The end of course examination covers information from all parts of the course.

Table 1: Course Marking Scheme

Assignments	Marks
Assignments 1 – 4	Four assignments, best three marks of the four count at 10% each = 30% of course marks.
End of Course Examination	70 percent of overall course marks
Total	100 percent

Table 2 Course Organisation

Unit	Title of Work	Activity	Assessment (End of Unit)
	Course Guide	Week	
1	Planning History & Theory	Week 1	-
2	Urban Ecology and Regional Analysis	Week 2	-
3	Urban Growth Analysis	Week 3	Assignment 1
4	Principles of Urban Design	Week 4	-
5	Sustainable Planning Framework	Week 5	Assignment 2
6	Land Use Policy	Week 6	-
7	Science in the Policy Process	Week 7	Assignment 3
8	Energy, Planning and Built Environment	Week 8	Assignment 4

HOW TO GET THE MOST OUT OF THIS COURSE

In distance learning, the study units replace the university lecturer. This is one of the huge advantages of distance learning mode; you can read and work through specially designed study materials at your own pace and at a time and place that suit you best. Think of it as reading from the teacher, the study guide tells you what to read, when to read and the relevant texts to consult. You are provided exercises at appropriate points, just as a lecturer might give you an in-class exercise.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit and how a particular unit is integrated with the other units and the course as a whole. Next to this is a set of learning objectives. These learning objectives are meant to guide your studies. The moment a unit is finished, you must go back and check whether you have achieved the objectives. If this is made a habit, then you will significantly improve your chances of passing the course.

The main body of the units also guides you through the required readings from other sources. This will usually be either from a set book or from other sources.

Self-assessment exercises are provided throughout the unit, to aid personal studies and answers are provided at the end of the unit. Working through these self-tests will help you to achieve the objectives of the unit and also prepare you for tutor-marked assignments and examinations. You should attempt each self-test as you encounter them in the units.

The following are practical strategies for working through this course:

1. Read the Course Guide thoroughly.

2. Organise a study schedule. Refer to the course overview for more details. Note the time you are expected to spend on each unit and how the assignment relates to the units. Important details, e.g. details of your tutorials and the date of the first day of the semester are available. You need to gather together all these information in one place such as a diary, a wall chart calendar or an organiser. Whatever method you choose, you should decide on and write in your own dates for working on each unit.

3. Once you have created your own study schedule, do everything you can to stick to it. The major reason that students fail is that they get behind with their course works. If you get into difficulties with your schedule, please let your tutor know before it is too late for help.

4. Turn to unit 1 and read the introduction and the objectives for the unit.

5. Assemble the study materials. Information about what you need for a unit is given in the table of contents at the beginning of each unit. You will almost always need both the study unit you are working on and one of the materials recommended for further readings, on your desk at the same time.

6. Work through the unit, the content of the unit itself has been arranged to provide a sequence for you to follow. As you work through the unit, you will be encouraged to read from your set books.

7. Keep in mind that you will learn a lot by doing all your assignments carefully. They have been designed to help you meet the objectives of the course and will help you pass the examination.

8. Review the objectives of each study unit to confirm that you have achieved them. If you are not certain about any of the objectives, review the study material and consult your tutor.

9. When you are confident that you have achieved the objectives of a unit, you can start on the next unit. Proceed unit by unit through the course and try to pace your study so that you can keep yourself on schedule.

10. When you have submitted an assignment to your tutor for marking, do not wait for its return before starting on the next unit. Keep to your schedule. When the assignment is returned, pay particular attention to your tutor's comments, both on the tutor-marked assignment form and also that written on the assignment. Consult you tutor as soon as possible if you have any questions or problems.

11. After completing the last unit, review the course and prepare yourself for the final examination. Check that you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed in this course guide).

FACILITATORS/TUTORS AND TUTORIALS

Sixteen (16) hours are provided for tutorials for this course. You will be notified of the dates, times and location for these tutorial classes. As soon as you are allocated a tutorial group, the name and phone number of your facilitator will be given to you.

Duties of your facilitator:

He/she will mark and comment on your assignment.
He will monitor your progress and provide any necessary assistance you need.
He/she will mark your TMAs and return to you as soon as possible.

You are expected to mail your tutored assignment to your facilitator at least two days before the schedule date. Do not delay to contact your facilitator by telephone or e-mail for necessary assistance if you do not

understand any part of the study in the course material, or you have difficulty with the self-assessment activities, or you have a problem or question with an assignment or with the grading of the assignment. It is important and necessary you acted the tutorial classes because this is the only chance to have face to face content with your facilitator and to ask questions which will be answered instantly. It is also period where you can say any problem encountered in the course of your study.

FINAL EXAMINATION AND GRADING

The final examination for **EHS 413 Urban Planning and Sustainable Development** will be of two hour duration. This accounts for 70 % of the total course grade. The examination will consist of questions which reflect the practice, exercises and the Tutor-Marked Assignments you have already attempted in the past. Note that all areas of the course will be assessed. To revise the entire course, you must start from the first unit to the ninth unit in order to get prepared for the examination. It may be useful to go over your TMAs and probably discuss with your course mates or group if need be. This will make you to be more prepared, since the examination covers information from all aspects of the course.

SUMMARY

EHS 413: Urban Planning and Sustainable Development is a course that introduces you to the scientific processes of shaping the physical setting for life to deal with the three-dimensional spaces in cities, towns and villages which concerns the environmental, social and economic factors. In contemporary context many cities and urban residents will be directly affected by many of the impacts of environmental changes, which include increased intensity and frequency of some environmental factors including flooding, strong winds etc and also water shortages and waste management. On the other hand, in the big cities around the world including African cities, migration (including rural-urban) is increasing greatly for the need of work, study purpose, treatment facility and the result is economical crisis, urban sprawl, high density, transport problem, increasing energy use, loss of vegetation and pollution.

The sustainable issues are not only dominated by environmental issues and economic concerns, but also include the social issues. Social sustainability refers to the personal and societal assets, rules and processes, physical boundaries of places etc. At the end of the course students will be introduced to the theoretical and interpretive views of human settlement from several disciplinary perspective; and be acquainted with the history of the planning discipline and key theories

of planning; and also to be familiar with the legal, political and organizational context in which planning is pursued in, especially, Nigeria. Finally, they will acquire tools and practical skills as urban planners need in order to understand urban and regional trends and analyse planning problems.

Some relevant questions to answer include:

- What are planner's concerns in urban planning and design?
- What are planner's methods in urban planning and design for sustainable development?
- What are the key issues in urban planning and design?
- What makes a sustainable city?

The list of questions that are expected to be answered is not limited to the above list. Finally, you are expected to apply the knowledge you have acquired during this course to your practical life.

I wish you success in this course!

MAIN COURSE

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MODULE 1 URBAN PLANNING

UNIT 1 PLANNING HISTORY AND THEORY

CONTENTS

1.0 INTRODUCTION

This unit on the **Planning History and Theory** teaches us more about the History and Theory of planning. It takes us through the roles of history and theory in understanding planning. It also introduces the types of theories, and levels of planning tracing planning through several stages from the Pre-Colonial, Colonial and Post-Colonial periods (focusing urban design and street system), through New Urban Forms; Federal Government; Industrial City; the Planning Movements; Parks Movements; and the different responses. It also traces the different movements up to the professionalization of Planning. Finally, it introduces tools for planning towards city efficiency (i.e. zonation, physical planning, and city renewal).

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- understand the general outline of the history of cities and the human attempts to plan them
- identify the roles of history and theory in understanding planning;

- establish the connection between urban change, city planning, and the societal forces that shape them
- establish connections between aspects of theory and urban studies with current planning practice
- engage in the current debates about cities and their planning within the historical context
- formulate questions for in-depth exploration in subsequent courses and research.

3.0 MAIN CONTENT

3.1 Roles of History and Theory in Understanding Planning

Planning means different things at different times and in different places. Planning is also an intricate and constantly evolving concept, which is a reflection of its historical response to prevailing environmental, economic and socio-cultural challenges. Town Planning: Describes the activity of planning in totality and is taken to refer also to "physical planning" as presently used in Nigeria, or "urban" or "city" planning (as in the United States of America) and also encompasses what in Britain has been traditionally called "town and country" planning. All the terms "physical", "town", "urban" and "city" make it clear that the focus of this discipline is the planning of the spatial, built, socio-economic, cultural and political environment, with an ultimate role of defining how land is used.

The history of towns and town planning in the most rapidly urbanizing parts of the world is still a relatively neglected topic. The growing body of academic work on planning history, nourished by networks such as the International Planning History Society, still deals mostly with Europe and North America, and is limited in the Third World Cities. What can make history worth writing, and what can make some history worth reading is the understanding of all the multifarious ways in which cities have evolved. The process of learning and understanding the background and growth of a city can offer insight into origins, growth, theories, personalities, crisis, organisational culture, current trends, and future possibilities. While the history of planning and the built environment in western cities particularly in Europe and North America "Modern" town planning in Africa is only traced from the inception of the British colonial government particularly after the enactment of the town and Country Planning Ordinances in the colonies where they found themselves. The demands of colonial management, as well as the new technologies of the Industrial Revolution had created the need for new occupational roles in handling colonial affairs and accordingly, the

setting of settlements and/or cities that would serve as Headquarters for colonial administration overseas.

3.2 Types of Theories in Urban Planning

a. **Utilitarianism** Classic utilitarianism aggregates individual values. The utilitarian public interest means maximising a hedonic value measuring all the affected individuals' 'pleasure' or 'happiness'.

b. **Modified utilitarianism** Underlies welfare economics, and some economists and philosophers (e.g. Sen and Singer) advocate its ethical principles.

c. **Unitary concepts** Unlike utilitarianism, which aggregates individual values, unitary concepts base the public interest on some collective moral imperative that transcends particular or private interests. Several arguments justify this view of the public interest.

d. **étatist theories** Which see a politically–legally constituted polity: a government, or state, as embodying the public interest. Here objective evaluation of proposed actions determines whether they are in the public interest, i.e. whether they are compatible with the collective interests of the state. This is the concept of the public interest that prevails in law, with judges applying legal criteria to determine whether a proposed action (e.g. a partnership agreement that limits a partner's occupational opportunities after termination) is 'in restraint of trade'.

e. **Deontic** Means rule- or norm-based, i.e. judging actions by their ethical content – 'is this action right?' – rather than (as utilitarianism does) by their consequences: 'will it do good?'. Deontic views see the public interest in terms of upholding individuals' and affected groups' rights, based on principles ranging from liberal democracy to ultra-liberal individualism and libertarianism.

f. **Libertarian individualism** Is the theory behind another deontic view of the public interest, which emphasizes the procedural respect for individual rights to the exclusion of almost everything else. In planning (and other forms of policy- and decision-making) these rights are institutionalized to varying degrees in different societies, under the broad headings of fairness or due

process, sound administration and transparency, and public or third party participation.

3.3 Urban Land, Planning and Governance Regime

a. The pre-colonial era

Land was held under communal ownership in Nigeria during the pre-colonial era. It was managed on the basis of the customs and traditions of the various ethnic groups that formed the country. Traditional rulers and family heads were vested with the right to manage land in accordance with the political, socio-economic, cultural and traditional norms that existed at that time. Community members had only use rights. The rights to use were heritable and partible inheritance which was common among male children, with few ethnic groups allowing females to inherit.

Land use patterns and urban development and governance outcomes also manifested political, socio-economic and cultural considerations. Cities varied in their outlook depending on the major considerations that underpinned their development. These included settlements that surrounded the King's (Oba) palace such as Benin City, reflected Muslim customs and traditions like Kano and Zaria, and those that started as war camps like Ibadan, which had no regard for orderly development as such but clustered around natural defences

b. The colonial era

The colonial period witnessed the imposition of British land administration laws on customary land tenure systems. In Northern Nigeria, the indigenous land tenure system as of 1804 had already been replaced by tenure system based on Muslim Maliki Law that vested ownership and control of land into the ruling class. However, the British colonial administration passed the Land and Native Proclamation Ordinance in 1910 converting all lands into public lands to be held and administered by the colonial governor for the benefit of natives.

Conversely, family lands and lands under the ownership of lineages in the south of the country were upheld, but their acquisition by outsiders required the approval of the Governor. Regulations, such as Ordinance No. 9 (1914), were also passed to enable the colonial government to undertake compulsory acquisition of land for public purposes. Formal urban planning

began with British colonial urban development activities particularly in Lagos in the late nineteenth century. These urban development activities included public works such as the construction of new dock facilities and a railway into the interior of the city in the 1890s and the passage of ordinances for Town Improvement (1863) and Public Health (1904). The 1928 Planning Ordinances created the Lagos Executive Development Board with the responsibilities of swamp reclamation, slum clearance, market planning and the development of suburban estates for African employees. Similar urban planning activities subsequently took place in Enugu, Zaria and Kano.

These colonial planning activities promoted spatial segregation. Three distinct types of urban settlement developments were created and governed with the assistance of the Township Ordinance No. 9 of 1917, namely European residential areas, non-European reservations and native communities. Two structures of local administration subordinate to the colonial government were also created. First, there was administration based on the indirect rule system, which relied on the Native Authorities and Native Treasuries by means of traditional chiefs who were responsible for the native communities. Second, forms of government supervised by colonial administrators. Townships and Municipal administrations were responsible for colonial urban areas, both European residential areas and non-European reservations. Unlike the native areas, the colonial urban areas were governed based on British urban development standards and were provided with the requisite infrastructure.

c. Post-colonial era

After Independence in 1960, colonial land policies subsisted with traditional land tenure arrangements until the passage of the Land Use Decree (LUD) in 1978. The Decree is now the basic framework for land administration in Nigeria. It was designed to unify land policies in Nigeria, to curb land speculation in urban areas, and to promote agricultural investment through secured land rights. Land holdings in Nigeria are now broadly classified into public/state, private and communal. Public/state lands are lands owned by government comprising federal, state and local governments and their agencies. Private lands are defined as those whose ownership is vested in private individuals, families, and lands under customary tenancies.

Communal lands are lands which have their ownership vested in communities. These lands are usually administered by community leaders mainly chiefs with the assistance of their councils of elders. The LUD classifies all lands in Nigeria into urban and rural lands. Lands that come under the control of the federal government, the Decree further vests urban lands with state governors and rural lands with local governments. This means that the responsibility for the administration and management of urban land, in the main, lies with state governments which results in the necessity for the creation of elaborate land bureaucracies and administrative procedures. The Decree established statutory rights of use which may be alienated in market transactions only with the consent of Governors. State governments, therefore, undertake allocation of and/or give consents to urban land grants and issue certificate of occupancy or formalise/register land transactions. These are undertaken by relevant state government agencies. A typical system for a state ministry involved in land administration is a Department of Land Services with divisions for: allocation, acquisition, valuation, land use and housing; a surveying and mapping department; and a deeds registry.

Several specific urban planning, development and governance initiatives including passage of regulations at both federal and state government levels have been undertaken since independence by successive post-colonial governments. However, the Town and Country Planning Ordinance (1946) continued to be the main planning legislation in Nigeria until the passage of the Urban and Regional Planning Decree (No.88) of 1992. The Decree was expected to revamp planning activities and make them more responsive to the socio-economic development needs of the country. However, planning practice has not been seen by analysts to depart from the colonial planning philosophy and the spatial configurations of planned urban environments have not been transformed. The next section, therefore, takes a detailed look at the current urban planning practice in Nigeria.

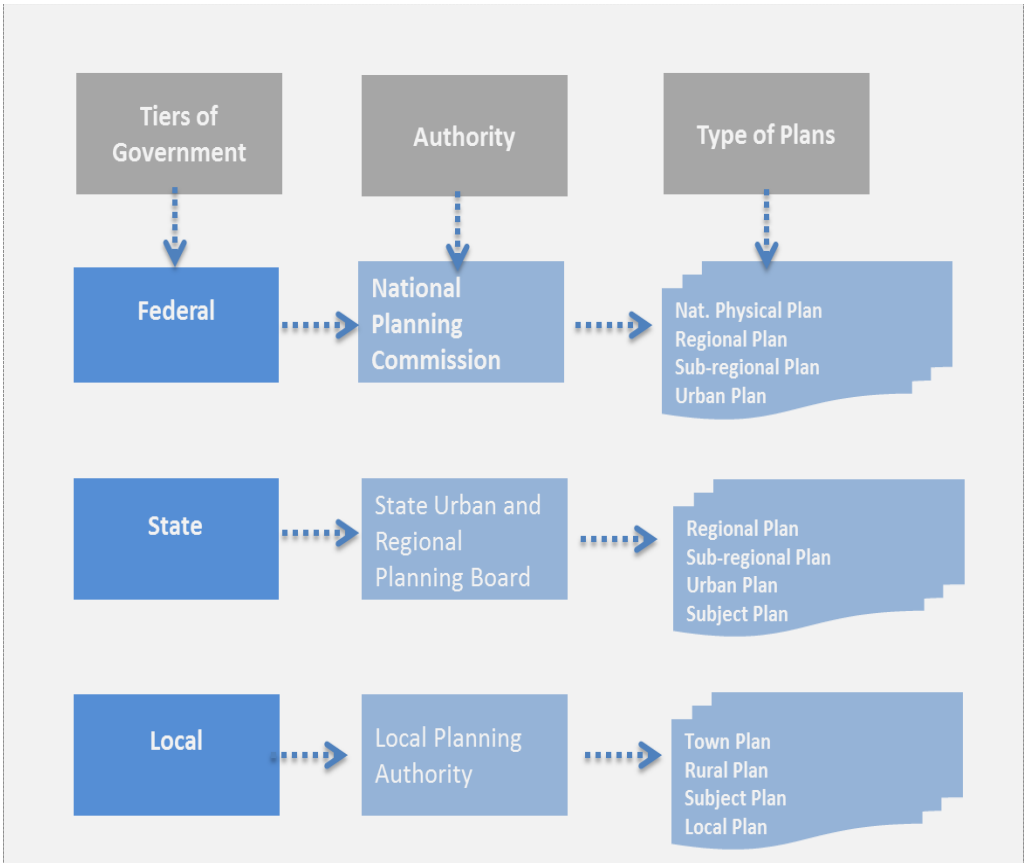

Figure1: Urban plan making responsibilities

3.4 Formal and Informal Urban Development Processes

It is now evident that formal approaches to land administration and urban planning and governance in Nigerian cities, as outlined above, have had significant constraints. Coupled with a fourfold increase in population since the 1950s, these constraints have culminated in a complex urban situation with a number of urban ills such as uncontrolled developments and disregard for development regulations. Many analysts (Gandy 2005, Falade 2012, Bloch 2014, Sawyer 2014 for instance) also cite the absence of strategic planning processes, the lack of production, implementation and enforcement of detailed land use plans, environmental degradation and inadequate and/or absent urban infrastructure as some of the underlying causes. However, two main forms of urban developments, formal and informal, have emerged as a resulted of the current urban land administration, planning and governance arrangement.

Formal developments are developments produced through formal land administration, planning and governance processes. As shown in the preceding section, the main legal framework for land administration in

Nigeria is the LUD. The Decree vests urban lands in state governors and converts old forms of estate into rights of occupancy meaning that the existing right of occupancy has to be covered by a Certificate of Occupancy issued by a state governor. Also, the Decree together with the Urban and Regional Planning Decree (1992) have made state and quasi-state institutions like local governments responsible for survey, planning and provision of infrastructure, as they have to ensure that urban lands are properly surveyed, planned and serviced. The formal development process, thus, entails execution of these activities by the required public institutions and allocation of land and/or grant of certificate of occupancy over customary lands and permissions for development.

In contrast, there are several possible definitions of informal development or settlement. For example, development either under legal or illegal tenure is usually characterised as being located in places of lowest environmental quality such as railway setbacks, damp sites and marshy land; lacking security of tenure; consisting of inadequate dwelling units; not following planning and urban development regulations; having questionable construction quality; and lacking basic infrastructure.

The above definition, however, raises queries about how to classify quality developments in better areas, which do not follow formal urban development processes. Therefore, the ongoing discussion considers informal developments or settlements as developments on land to which their occupants have no legal claim or developments that defy land use planning and building permit requirements. It is development that disregards official laws on occupation of land, its use, sub-division standards and, conveyance and which further may sidestep the requirement for building permits regardless of quality. Informal developments can be further classified into squatter and unauthorised developments. Squatter developments mean illegal occupation of land or developments without permission whereas unauthorised developments are those with land rights but without planning and building permissions.

The informal/alternative forms of urban land delivery and development comes in two main forms:

(i) non-commercial grants from the customary land owning group – community, family or clan to members of the group, or as inheritance from members of land owning groups who had previously been allocated land; and

(ii) purchase of land from customary land owning groups or private land owners who had previously purchased large tracts of land and sub-divided them. The private land owners are usually land and estate brokers.

Perhaps a third form is encroachment on or sale of public lands or compulsorily acquired lands. Sale of such lands are sometimes made possible due to non-payment of compensation by government to expropriated owners who often feel empowered to sell these lands under the circumstance. Formal, government-sanctioned, predominantly infrastructure-led or large scale estate development is supported through access to land and/or concessions. In contrast, smaller scale infilling within urban centres and small to medium scaled development at the expanding edges of the city are often realised through informal means and outside the formal planning system. The inner cities continue to grow through unplanned, in-filling development schemes manifested by conversion of every space into development often without adequate infrastructure and social amenities. However, urban developments in Nigeria (whether formal or informal) are also driven by a number of actors.

There are three main groups that are driving the demand for development: people seeking rental accommodation; the landowners, developers and home-owners; and the industries and manufacturers. These categories are useful when considering urban dynamics and the form of development taking place but it is also important to note that these categories are not homogeneous and that within each there will be different requirements. The range of needs exhibited by people seeking rental accommodation highlights this variability. Newly arrived residents often look to find affordable and shared accommodation within the central part of the city while networks and further options are explored. Those in regular employment may chose to live in the outer areas and either commute or source rented shared accommodation during the week. These different dynamics affect the supply and form of residential accommodation.

4.0 CONCLUSION

The challenges facing Nigeria, in terms of population growth, spatially expanding cities and provision of attendant infrastructure, against a backdrop of a changing climate and increased vulnerability, present both issues of policy and of delivery. This report has examined the land development and urban planning systems within Nigeria and highlighted examples of development taking place. The exercise has endeavoured to

build a greater understanding of the dynamics of physical development in Nigerian cities and towns. In order to understand today's situation, this report has revisited past practice and history. This contextualisation and presentation of change over time has enabled the complexity of access to land, formal planning systems and governance structures to be described. Through this, the current duality – in formal and informal terms – of land administration, urban planning and governance systems has been emphasised.

Contemporary planning practice recognises the iterative nature of planning both in the process of plan making and governance. The contribution that this research makes to the policy debate for Nigerian cities centres on developing a deeper picture of the development practice and relating this to future policy making. There is a clear reform agenda emerging that needs to be supported to enable greater access to land and adequate provision of housing and infrastructure. The national urban development policy recognises the current deficiencies of what is deemed the 'planning system' and the need to develop the capacity of each tier of government.

As noted earlier in the report, the need for metropolitan scale planning, regional planning and cross-boundary cooperation is central to the sustainable future of Nigerian cities. In order to achieve inclusive development and maximise economic productivity, development should not take place in isolated islands or piecemeal. Rather, as the pace of urbanisation continues, policy makers will need to consider how to address existing deficits while at the same time allowing for growth and future demands.

5.0 SUMMARY

Urban Planning is primarily about planning a spatial, built environment. Tracing the history of a city can offer real understanding of the built environment in terms of its origin, growth, development, current situation and future possibilities. In most Africa, urban development can be traced through the period of colonialism. City planning in most parts of Nigeria can be followed through the pre-colonial, colonial and post colonial periods.

6.0 TUTOR-MARKED ASSIGNMENT

1. What makes cities special?
2. What is the relevance of history in understanding the development of cities?

3. How can you tell that you are in a city? What are some of the metaphors that have been applied to the city and what insights do they offer?
4. Trace the history of any city of your choice in Nigeria.

7.0 REFERENCES/FURTHER READING

Abubakar, I.M. (2014). Abuja City Profile. In: *Cities*. 41, 81-91.

Adam, A.G. (2014) Informal Settlements in the Peri-urban Areas of Bahir Dar, Ethiopia: An Institutional Analysis In: *Habitat International*, 43, 90-97.

Adeniyi, P. (2013). Improving Land Sector Governance in Nigeria. Implementation of the Land Governance Assessment Framework. A Synthesis Report. Department of Geography, University of Lagos.

Aluko, O. (2011) Sustainable Housing Development and Functionality of Planning Laws in Nigeria: The case of Cosmopolitan Lagos. In: *Journal of Sustainable Development*, 4(5), 139-150.

Childe, V.G. (1950). "The Urban Revolution." In: *The City Reader*: 4th Edition, LeGates, R.T. and F. Stout (Eds.). New York, NY: Routledge. (pp. 27-34).

Hall, P. (2002). "Cities of Imagination." In: *Cities of Tomorrow: An Intellectual History of Urban Planning and Design in the Twentieth Century*. Oxford, UK: Blackwell. (pp. 2-12)

Kitto, H.D.F. (1951). "The Polis." In: The City Reader: 4th Edition, LeGates, R.T. and F. Stout (Eds.). New York, NY: Routledge. (pp. 35-40).

Kotkin, J. (2006). *The City: A Global History*. New York, NY: Modern Library. (pp. 19-40).

Kusimba, C., S. Kusimba, & B. Agbaje-Williams. (2006). "Pre-Colonial African Cities: Size and Density." In: *Urbanism in the Preindustrial World*, Storey, G., R. Storey, L. Liu, et al. (Eds.). Tuscaloosa, AL: University of Alabama Press. (pp. 145-158).

Misra, T. (2016). "Watch 6,000 Years of Urbanisation in three Minutes." Citylab (June 15).

Morris, A.E.J. (1994). "The Early Cities." In: *History of Urban Form Before the Industrial Revolutions: 3rd Edition*. New York, NY: Longman Scientific and Technical. (pp. 1-34).

UNIT 2 URBAN ECOLOGY AND REGIONAL ANALYSIS

CONTENTS

1.0 INTRODUCTION

Environmental challenges faced by cities around the world are more complex now than at any other time in history. In many parts of the world, and notably in the Asia Pacific, rapid economic growth, decentralisation, privatisation, and related socio–cultural changes are leading to the emergence of a complex decision making environment. New concepts and approaches are needed to find constructive solutions to environmental issues. This section focuses on the emerging urban ecosystems analysis (UEA) to highlight its merits and to point out new tools and methods in which UEA can be applied to provide useful information to decision makers. It is believed that crucial information for policy makers includes the geographic scale of impacts from urban environmental activities and linkages between socio–economic, cultural and bio–physical factors. UEA can help in both instances. It is unlikely that UEA would have a single methodology. Instead, we envision a comprehensive array of guiding methods, tools and techniques to choose from, so that unique situations can be dealt with appropriately. Further, new combinations of techniques are needed to assess the environmental impacts of proposed policies, plans, and programmes.

2.0 OBJECTIVES

By the end of this unit, lecturer, you will be able to:

- understand that urbanisation is an important driver to environmental change.
- differentiate that cities are impacting on the environment differently
- know that cities in developed countries have already overcome their environmental problems
- note that urban environmental challenges in developing countries include inefficient modes of resource use, such as in the water supply, housing, or energy, and limited absorptive capacity of pollution and flooding.

3.0 MAIN CONTENT

3.1 Urbanisation and Environmental Change

Urbanisation is an important driver to environmental change and it is not the only urban–related influence. The conversion of land to urban uses, the extraction and depletion of natural resources and the disposal of urban wastes cities as well as urbanisation in general are having global impacts. All cities, however, are not impacting the environment in similar ways. While developed world cities have largely overcome their traditional environmental problems (waste water removal, sanitation, water supply, indoor air pollution, etc), attention has turned to their impacts on ecosystems further away as well as those larger in scale (see for example Low, Gleeson, Elander and Lidskog, 2000). Cities in the developing world are more concerned with other issues. Urban environmental challenges in developing countries have been divided into two categories: inefficient modes of resource use, such as in the water supply, housing, or energy, and limited absorptive capacity of pollution and flooding. Brandon and Ramankutty (1993) classify the key urban environmental challenges in the Asian region as: water pollution; air pollution; solid waste management; and inappropriate land use. Studies of the consequences of urban activities suggest ever–increasing challenges to cities at all levels of development.

A number of factors have added to this complexity. First, the impacts of contemporary industrial processes and the toxicity of many materials used are unknown. Sometimes, what was previously seen as an environmental benefit ended up as an ecological disaster. Second, cities within fast–growing economies are going through a socio–economic and

cultural transition, and as such, are facing the environmental challenges of low, middle, and high–income societies simultaneously. Third, while the drive for decentralisation is leading to the transfer of responsibilities for the urban environment from central agencies to local governments, in many cases decentralisation has not been accompanied with greater financial empowerment of local governments. This situation has forced cash–starved local governments to look for other partners, such as those in the private sector, to address environmental issues. International development organisations have also become more active in the urban scene, relentlessly pushing for privatisation of urban utilities. Fourth, more players are involved in, or desire to be involved in urban environmental decision making creating increasingly complex political situations. This includes, for example, both local voices and international utility companies offering their services in provision of urban environmental infrastructure and services. In these increasingly complex circumstances, new concepts and approaches are needed to tackle environmental challenges.

3.2 Urban Environmental Concerns

Issues of environmental concerns in urban centres are basically the following:

i. Climate and energy considerations
ii. Natural cycles (including water) and their connected social processes
iii. The urban-rural nexus
iv. The urban footprint on the world outside the urban space
v. Urban infrastructure and transport systems
vi. The future Green development and Growth and its economic impacts
vii. The directions needed for the knowledge production system to match these “green challenges”

Climate issues are of central concern in these connected systemic challenges. Climate change is about the gradual increase of the global mean temperature curve, also noting that the distinct increase over the last half a century also corresponds to an earlier unseen dramatic increase in the very much longer time perspective of thousands of years. This can be seen in how it affects all the other six factors below it. It is clearly understandable that climate affects many of the activities that take place in the cities. Temperature-driven water scarcity intensification is expected to grown in intensity, with severe consequences also for urban spaces. Many of the large cities of the

world are situated along coasts. Energy security is a relevant dimension for anybody, not least for urban activities. Major infrastructures are very often connected to urban spaces and are often expressions of it. Health-related deaths often have urban connotations as was tragically demonstrated just a few years ago in many countries around the world. Tourism and food security have urban connotations and, as an expression of general environmentally oriented performance for sure "sustainability" indicators, are extremely important for urban activities.

Activities taking place in cities contribute to the process of climate change. These can be direct – for example from factories or motor vehicles operating within the city. But they can also be indirect – related to the production of goods and services that are consumed within urban boundaries by urban residents. In addition, urban authorities may provide or purchase services that are associated with emissions. Effective mass transit systems can be an important means of reducing emissions from transportation as they can provide an incentive for people to reduce their use of private motor vehicles. However, this is also dependent on urban form and density that shape how efficient these systems can be. Considerable differences in greenhouse gas emissions associated with transportation in several different cities, and which makes it clear that the level of development alone is not the main driver of emissions. However, it must also be remembered that non-motorised transportation represents a considerable proportion of journeys made in low- and middle-income cities (which are often densely settled). Another area in which local government decisions can exercise considerable influence is in the management of solid waste, as landfills can generate high quantities of methane (which is a powerful greenhouse gas). Effective landfill management (including flaring or the use of waste-to-energy) can reduce emissions from this source considerably. In Nigeria, issues of industrial pollution are known with all the industrial cities including Lagos, Ibadan, Kano, Kaduna Onitsha etc.

(i) **Ecosystems within cities:** One extremely important goods and service–related issue for urban ecosystems is their ability to provide "healthy" environments both for the natural ecosystem, as well as for their citizens. Those exploring the issues of health and cities are increasingly turning to an ecological or ecosystems approach. This is one case where the scale of ecosystems lies within the cities. In the least developed cities and the poor neighbourhoods in cities of the developing world, health, water, and sanitation (which we also term the "brown agenda") are priority issues. Indeed, for cities in the developed world as well,

these are the dominant ecosystem challenges. Household sanitation and access to water are the most important environmental issues in these poorer cities and neighbourhoods, as pollution of water with human excreta and other wastes is a major problem. Further, while primarily a rural issue; indoor air pollution may also affect tens of millions of people in Third World cities.

In addition to what has been described above, examples of analysis of ecosystems within cities consist of focuses on city parks, wildlife in those parks, and urban agriculture. In this perspective, urban ecologists have explored the city as a natural environment. Urban ecology includes the study of the interaction between living things and their environment in the city, a profoundly altered ecosystem. This contrasts with the Chicago School's sociological approach to studying the social and spatial organisation of the city. This perspective offers ecologists the opportunity to address the practical problems related to the anthropogenic impact on ecological systems, and also provides opportunities to examine fundamental ecological questions concerning the structure, function, and organization of ecosystems in general.

(ii) **City as an ecosystem:** Understanding the city as an ecosystem began with two different, but related, types of studies. Urban metabolism research generated a holistic view of the city as a consumer and digester of resources and a creator of waste products. This perspective started as viewing the city as an organism with its own metabolic processes. In order to overcome shortages of water and pollution of water and air, the city should be viewed as an organic body with metabolic processes. As such, inputs and outputs could be measured, and this information could help to form public economic policies. Their approach was to examine the complex interactions that take place within cities, rather than studying specific problems in isolation. This technique is illustrated by the flow of important materials through Hong Kong. Studies along these lines include those that explore the energy, water, and nutrient balances of cities, along with the flows of waste materials, among others.

(iii) **Cities within regional and global ecosystems:** The "global" city literature that emerged in the mid–1980s suggests that cities are increasingly linked to each other through flows of goods, services, investment, finance, people, and knowledge. At the

same time, global cities are also linked with and are increasingly impacting ecosystems elsewhere and at a larger scale. Folke et al. (1997) found in their study of northern European cities that the largest 744 cities accounted for the consumption of 25 per cent of the world's annual sea catch. This finding prompted these scholars to warn, "the web of connections linking one ecosystem and one country with the next is escalating across all scales in both space and time. Everyone is now in everyone else's backyard".

Since cities, particularly those of the developed world, cannot be self–contained "sustainable" units, they should know what their ecological footprints are and therefore contribute to reducing them. Cities are key to the promotion of global sustainability, yet we are only beginning to understand the ways in which their activities impact the local, regional, and global ecosystems.

(iv) Tools for urban ecosystems analysis

In recent years the availability of data and tools in the environmental field has increased dramatically making it possible to conduct the kind of complex and holistic analysis that an ecosystem approach requires. Apart from a general increase in interest in environmental protection, there are three factors behind this availability. First, computer modelling and simulation tools are becoming highly developed and more readily available. This is partly due to availability of faster and cheaper computers, and an exponential interest in and development of computer applications, including modelling tools. Second, in recent years geographic information systems (GIS) have emerged as a powerful tool for conducting spatial analysis. GIS is the basis of environmental modelling. Third, the availability of environmental data has increased over the years, which is partly due to the ubiquity of the Internet. Substantial amounts of environmental data, including GIS layers, are now available on the Internet.

Popular GIS packages such as ARCINFO and ARCView from ESRI (Environment Systems Research Institute) are now available in powerful and relatively inexpensive desktop versions. Moreover, they now include modelling capabilities and several specialized planning–related modules that can be added to basic software. ArcView now comes with an easy–to–use programming language called "Avenue", which can be used to build models with a desktop GIS. A number of third–party models have been developed using Avenue. Also, the new software packages are easier to integrate or link with one another,

as nearly all of them use Microsoft Visual Basic as their macro language. Not only Microsoft software has this capability; other developers (including ESRI) now also include this feature in their products. In short, better software products (easy to use and with more modelling capabilities) are now available, and they are easier to integrate. So the hurdles of using computer tools to solve complex urban ecosystem problems have been reduced considerably, so much so that there is considerable choice when building innovative ”blends” of computer tools for practical application.

An additional reason that favours the urban ecosystem approach is the availability of resources on the Internet. A surprisingly large range of data and models is now available on the Internet, at nominal cost or even free of charge. The resources available on the Web are expanding on a logarithmic scale.

At this point in time, the Internet offers access to more potential individual components of an urban ecosystem methodology than has ever been available before. Professionals conducting UEA will benefit from understanding new tools for social and natural/ environment analyses. These new tools are computer based demanding a certain level of computer literacy: experience with spreadsheets, database management, basic GIS functioning and the basics of modelling will also come in handy. In addition, knowledge of a number of other computer tools, like field–specific substantive applications (related to the environment, or transportation, etc.) is ideal, as is some degree of knowledge in GIS–based modelling and remote sensing methods. With the profusion of tools and data available on the Internet, professionals involved in urban ecosystems analysis will be increasingly easy to undertaken.

An ecosystems approach employing the above–mentioned points can work well in tandem with the environmental assessment tools such as strategic environmental assessment (SEA). SEA is often quoted as the way to evaluate environmental implications of proposed policies, plans, and programmes. Currently, however, SEA is still in the developmental stage. Quite often the methods used for environmental impact assessments (EIA) are also used for conducting SEA. However, current methods are not suitable for evaluating policies, plans, or programmes. SEA, therefore, remains deficient in this regard. UEA could provide the necessary structure for conducting these and other types of assessments.

New methods for analysing urban environmental problems have been presented by a number of researchers. Exline et al. (1982) stressed their importance, Grove (1997) pointed to particular ones, and Vasishth (2002) has indirectly described some by describing a city as layered, overlapped, and nested arrangements of subsystems, systems, and supra–systems organized in scale hierarchical arrangements. However, a comprehensive compilation of such entities does not yet exist. By and large they remain scattered throughout the vast literature of related professional fields. The general principles found in each approach described in the following paragraphs.

a. **Systems approach** The systems approach is helpful in examining the linkages between particular environmental phenomena and the social and natural systems. The systems approach offers a hierarchical method of clarifying the relationship of each part to the whole.

b. **Biological analysis** Some of the principles in this approach are balance, competition, and the ecological processes of invasion, succession, and dominance. Hierarchies, patchiness, and perturbation are some other underlying principles of ecology. Others include resilience, resistance, persistence, and variability.

c. **Spatial analysis** Principles such as spatial heterogeneity and scale differentiation, methods such as landscape, watershed analyses and urban land–cover models, and tools such as GIS and Remote Sensing fall under this category.

d. **Material flow analysis** These include flows of materials and energy, metabolism studies and ecological footprint studies.

e. **Social analysis** This approach is based upon principles such as social differentiation or morphology, social identity, sociocultural hierarchy, access and allocation of resources such as wealth, power, status, and knowledge; methods like rapid rural appraisal, surveys, etc; and tools such as transects, flow diagrams, decision trees, Venn diagrams, etc.

The above list is indicative of the kinds of methods that can be applied in UEA. It is our objective in this initiative to bring together scientists in various related fields, and compile an elaborate array of the concepts, principles, methods, techniques, and tools that can help in formulating urban ecosystems methodologies. There have been some initiatives in the past that could be built upon but much remains to be done.

4.0 CONCLUSION

To analyse the rapidly escalating and increasingly complex urban environmental challenges around the world requires the development of comprehensive approaches. Urban ecosystems analysis is the holistic approach that can fulfil this need. However, in order to be truly useful, UEA will have to satisfy the needs of policy makers. The research initiative at UNU/IAS has been undertaken with the goal of developing UEA. This report has outlined the foundations of our approach and identified a number of tools and methods that could be useful in its implementation.

Specifically, an urban ecosystems methodology is envisioned as an innovative compilation of guiding principles, methods, and tools selected from a comprehensive array of these entities. This compilation needs take place in light of the environmental challenge being analysed. In order to put UEA in the proper context of scale and city income levels, a three–dimensional framework has been proposed. This framework has its underpinning in urban environmental transition theory, and helps in determining the sets of relevant environmental issues for a particular scale at a given location.

5.0 SUMMARY

Cities are human creations, and they have always been centres of hope and inspiration: they are where the products of nature are used to create better qualities of life, and to facilitate cultural and intellectual achievements. Their cultural diversity is part of their vitality and dynamism. It stems from many sources and is reflected in many ways in urban areas, particularly determining people’s priorities and values for the environment and ecological resources. This cultural diversity must always be taken into account when analysing urban ecosystems.

The great cities of the world have a balance of fine architecture and open space that in ecological terms offer not only a good human habitat, but also opportunities for biodiversity. This pro–active role of people in the urban environment continues to produce habitat improvements and

to beneficially manage ecosystems, as the best urban wildlife reserves indicate. Nevertheless, huge challenges are posed by many cities, with high concentrations of poverty found juxtaposed to wealth in many urban areas.

Urban ecosystems may be viewed in three ways:

1. As the built–up areas that are the habitat of urban people, their pets, their garden plants, the adapted animals and organisms (birds, moulds, etc) and pests (rats, weeds, parasites. etc). The survival of these areas depends on outside (external) support in the form of energy, water, and materials inputs.
2. As the immediate urban life–support system of the urban area and its surroundings (the peri–urban area), providing such ecological services as water supplies, sources of aggregates, areas for landfill, recreation zones, watershed protection, greenhouse gas uptake, and biodiversity.
3. As the areas affected by urban activities as a driving force, through provision of life–support services to urban areas, including supplies of food, energy, water, and materials. Also those areas affected by the emissions and waste flow from urban areas. For any individual city these may have a global outreach, with energy (coal, natural gas or oil).

6.0 TUTOR-MARKED ASSIGNMENT

1. List as many key environmental challenges that face any major city of your choice.
2. How central is the climate to the city's systemic challenges?
3. Describe city as an ecosystem.
4. What are the tools for urban ecosystem analysis? Explain the use of any one tool in the analysis.

7.0 REFERENCES/FURTHER READING

Alexander, E.R. (1992). *Approaches to Planning: Introducing Current Planning Theories, Concepts and Issues*. (2nd ed.). Amsterdam: Gordon & Breach.

Alexander, E.R. (2001). 'The Planner-prince: Interdependence, Rationalities and Post-communicative Practice' In: *Planning Theory & Practice* 2 (3): 313–26.

Boyden, S, Millar, S, Newcombe, K, & O'Neill, B., (1981). *The Ecology of a City and its People: The Case of Hong Kong*, Canberra, Australian National University Press.

Douglas, I, (1983). *The Urban Environment*. London: Edward Arnold.

ECTP (1998) 'The New Charter of Athens 1998: European Council of Town Planners' *Principles for Planning Cities'*, http://www.ceu-ectp.org/en/athens.html

Exline, C H, Peters, G L, & Larkin, R P (1982). *The City: Patterns and Process in Urban Ecosystems*. Boulder, Colorado, Westview Press.

Fitzpatrick, K, & LaGory, M. (2000). *Unhealthy Places: The Ecology of Risk in the Urban Landscape*. New York, Routledge.

Gilbert, O L. (1989). *The Ecology of Urban Habitats*, New York, Chapman and Hall.

Grove, J M, & Burch, W R, (1997) "A Social Ecology Approach and Application of Urban Ecosystem and Landscape Analyses: A Case Study of Baltimore.

Howe, E. (1994). *Acting on Ethics in City Planning. New Brunswick*. NJ: CUPRRutgers The State University of New Jersey.

Kjellen, M, (2001). *The Citizens at Risk: From Urban Sanitation to Sustainable Cities*, London, Earthscan Publications.

Lo Piccolo, F. & Thomas, H. (2001) 'Legal Discourse, the Individual and the Claim for Equality in British Planning', *Planning Theory & Practice* 2(2): 187–201.

Moore, T. (1978) 'Why Allow Planners to Do What They Do? A Justification from Economic Theory', *Journal of the American Institute of Planners.* 44(4): 387–98.

Nozick, R. (1974). *Anarchy, State and Utopia*. New York: Basic Books.

Perera, V. (1997). *The Cross and the Pear Tree: A Sephardic Journey*. London: Flamingo-Harper Collins.

Sassen, S, (1991) *The Global City: New York, London, Tokyo*, Princeton, Princeton University Press.

Vasishth, A & Slone, D C (2002) "Returning to Ecology: An Ecosystems Approach to Understanding the City" In: Dear, M J (ed) *Chicago to LA: Making Sense of Urban Theory*. Thousand Oaks, Sage Publications.

UNIT 3 URBAN GROWTH AND ANALYSIS

CONTENTS

1.0 INTRODUCTION

This Unit on **Urban Growth Analysis** is about the dynamics of land use change as a scientific challenge to humanity. The course defines land cover to include vegetation and artificial constructions covering the land surface. The course analyses livelihood in cities and from the point of view of land resources and the continued changes/conversions of land use types. In most of Africa, there is continued conversion of agricultural land use in the face of higher demands for food, energy, water, land for human settlements, better civic infrastructural amenities and facilities for standard quality of life. The course studies the problems of pressure of population on land.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- know the key ingredients of urban growth, quantification and knowledge of rate and trends of urban growth
- analyse the spatial and temporal data with the help of technologies as Remote Sensing and GIS
- know the key elements of regional planning.

3.0 MAIN CONTENT

3.1 Land Use/Land Cover in Urban Areas

Urban growth identification, quantification, and the knowledge of rate and trends of growth would help in regional planning with better infrastructure in environmentally sound way. This requires analyses of spatial and temporal data, which can be done with the help of spatial and temporal technologies such as Remote Sensing, Geographic Information System (GIS) and Global Positioning System (GPS). Understanding the phenomenon of urbanisation and analyses of patterns of urbanisation would help in addressing the needs of the present and future needs of a region. This plays a key role in planning for infrastructure and becomes crucial in regional planning especially when resources are scarce.

Unchecked urbanisation is often referred colloquially as sprawl poses serious problems in infrastructure planning and implementation that leads to unforeseen consequences. In this context, prior knowledge of patterns of sprawl and its trend would help the development machinery in planning the basic necessities of a region. This requires spatial and statistical data for a different time period. Temporal data acquired remotely (i.e. remote sensing data) for a region along with the historical data of a region (such as population growth patterns, etc.) would help in finding out the patterns and trends of sprawl. Geographic Information System or GIS would help in integrating both spatial and statistical data and generate themes based on various growth trends.

The process of urbanisation is fairly contributed by population growth, migration and infrastructure initiatives resulting in the growth of villages into towns; towns into cities and cities into metros. However in such a phenomenon for ecologically feasible development, planning requires an understanding of the growth dynamics. Nevertheless in most cases there is lot of inadequacies to ascertain the nature of uncontrolled progression of urban sprawls. Sprawl is considered to be an unplanned outgrowth of urban centres along the periphery of the cities, along highways, along the road connecting a city, etc. Due to lack of prior planning these outgrowths are devoid of basic amenities like water, electricity, sanitation, etc. Provision of certain infrastructure facilities like new roads and highways; fuel such sprawls that ultimately result in inefficient and drastic change in land use affecting the ecosystem. Usually sprawls take place on the urban fringe, at the edge of an urban area or along the highways in most parts of the globe. The need for understanding urban sprawl is already stressed and attempted in the developed countries. Typically conditions in environmental systems with gross measures of urbanisation are correlated with population density with built-up area. This substantiates the need to analyze and understand the urban sprawl phenomenon in the context of a developing country to address effective resource utilization and infrastructure

allocation. The most common form of sprawl either radial (across a city) or along the highways is being investigated by many. In addition to these sprawls, there is a need to understand the sprawl that is taking place, when a city/town is connected by a road, which is most common in developing countries.

Normally, when a rural pockets are connected to a city by a road. At initial stages, development in the form of service centres such as shops, cafeteria, etc. can be seen on the roadside, which eventually become the hub of rural economic activity leading to sprawl. An enormous amount of upsurge could be observed along these roads. This type of upsurge caused by a road network between urban / semi-urban / rural centres is very much prevalent and persistent at most places in India. These regions are devoid of any infrastructure, since planners are unable to visualise this type of growth patterns. This growth is normally left out in all government surveys (census), as this cannot be grouped under either urban or rural centre. The investigation of patterns of this kind of growth is very crucial from regional planning point of view to provide basic amenities in these regions.

In this section, an attempt is made to identify the sprawl pattern, quantify sprawl across roads in terms of Shannon's entropy, and estimate the rate of change in built-up area over a period with the help of spatial and statistical data of nearly three decades using GIS. The physical expressions and patterns of sprawl on landscapes can be detected, mapped, and analysed using remote sensing data and geographical information system (GIS) with image processing and classification. The patterns of sprawl could be described using a variety of metrics and through visual interpretation techniques. Characterisation of urbanised landscapes over time and computation of spatial indices that measure dimensions such as contagion, the patchiness of landscapes, fractal dimension, and patch shape complexity are done statistically by Northeast Applications of Useable Technology In Land Use Planning for Urban Sprawl.

In the recent years understanding the dynamics of sprawl, quantifying them and subsequently predicting the same for a future scenario has gained significant importance. Batty et al. (2001) are successful in analysing this phenomenon using differential equations and developing a model to simulate sprawl using cellular automata for the Ann Arbor, Michigan Region. Various issues concerned with quantifying urban sprawl phenomenon are addressed to arrive at a common platform for defining the process. Most of these studies quantify sprawl considering the impervious or the built-up as the key feature of sprawl.

The Shannon's entropy index reflects the concentration of dispersion of spatial variable in a specified area, to measure and differentiate types of sprawl would be useful in quantifying the sprawl. This measure is based on the notion that landscape entropy or disorganization increases with sprawl. The urban land uses are viewed as interrupted and fragmented previously homogenous rural landscapes, thereby increasing landscape disorganisation.

1.3.3.2 Built-Up Area as an Indicator of Urban Sprawl

The percentage of an area covered by impervious surfaces such as asphalt and concrete is a straightforward measure of development and these surfaces can be easily detected and interpreted in remotely sensed data. This is based on the assumption that developed areas have greater proportions of impervious surfaces, i.e. the built-up areas as compared to the lesser-developed areas. Further, the population in the region also influences sprawl. The proportion of the total population in a region to the total built-up of the region is a measure of quantifying sprawl. Epstein et al. (2002) also employ a similar technique for mapping suburban sprawl and compared the result with rural and urban centres. Thus the sprawl is characterised by an increase in the built-up area along the urban and rural fringe and this attribute gives considerable information for understanding the behaviour of such phenomenon. Earlier studies carried out in parts of the world highlight and conform that the built-up area could be used as fairly accurate parameter for urban sprawl analyses. The other parameter that is considered as an indicator of urban sprawl is the night time data captured with the help of radars or geostationary satellites.

3.3 Population Pressure on Land

Cities grow due to the rapid increase in world population and the migration of people from villages to cities. In the developing countries, the population growth has been more unstable & some cities are facing unplanned and uncontrolled settlements (e.g. slums) at the densely populated areas. Human beings have maximum population on earth although it decreases with high death rate due to illnesses, infections, famines; accidents and war but comparatively fertility rates should be high for species survival. Many factors affect the rate of change of population. As number of individual increases, the problems related to it are also increased. The main reasons that affect growth of population are the natality, mortality, immigration and migration. The natality is the ratio between births and individuals in given population and time. The

mortality is the ratio of number of deaths to individuals present in given area and time. Migration is the number of people enters in or out of an area. The rate of change of population size is affected by these factors in a particular region.

Movement of people to developed countries for better job opportunities, war, and natural disasters like hurricanes, cyclones, earthquakes etc. There is great pressure on the natural resources (water, land) due to overpopulation. Among all the natural resources, Land is the most important one. All agriculture, animal and forestry productions depend on the land productivity. The entire land ecosystem, which composed of soil, water and plant, and soil biodiversity, is used to fulfil the community demand for food, energy, water requirement. The unmanageable use of land is the main reason for destruction of our environment. For the sustainable development of an area, regular monitoring of land cover/ land use changes is essential. Overpopulation, consumption, overuse, wastage and misuse of resources have strained the earth's carrying capacity. The demands that put pressure on our environment are also alter the future of sustainability on earth. Regular monitoring of urban land cover/ land use changes is necessary for sustainable development of an area. In India, increase in population size due to unplanned activities which leads to urbanization that reduces the agricultural land. This is also having serious impacts on the quality of environmental resources.

Environmental degradation occurs not only due to population growth but also on other impacts that contribute to environmental degradation. The results of such population growth for developing countries span three areas:

a. Changes in land use,
b. Disposal of harmful waste to the environment and
c. Depletion of natural resources.

As growth of population occurs, this extended growth begins to alter our environment. This concept draws upon the idea that every individual has certain basic needs. As natural resources are used, wastes are generated and disposed of. Thus, the misuse of resources, generation of waste and environmental damage relies on that society's lifestyles and pattern of consumption. Population growth is determined by number of individuals added to the population by birth (natality) and immigration from other area and subtracted by the population decreases by death rate (mortality) and emigration to other area. It increases the size of population and

population lost by deaths (mortality) and emigration, reduces the population size.

Population growth = (Natality + Immigration) - (Mortality + Emigration) Human population size increases due to the following reasons:

1. Change in population size: Growth of population is affected by the entry and exit of the people in given area.
2. Population movement (emigration, immigration): Both these factors affect growth of population.
3. Circumstances origin of a country that lead people to emigrate- As we all know people of particular area move in and out due the following reasons:

    - No job opportunities.
    - Poverty.
    - War.
    - Environmental disasters (flood, drought, famine, earthquake, etc.)
    - Offers that attract people:
    - Economic opportunity (jobs, industries)
    - Political freedom.
    - More availability of resources (availability of better food, habitat, etc.)

World population counted 6.8 billion in 2009, and are predictable to climb to 9.2 billion in 2050. According to Prospects of World Population, this growth will take place in the developing countries (United Nations, Department of Economic and Social Affairs, Population Division (2015). The ease of use of sustainable resources which is placing competitive stress on the basic resources support to biodiversity and reduces the way of life, do not affect the population growth. Overpopulation influences land use patterns with consumption behaviours and productive activities of people. “Consumption by human had far exceeded resources available for every individual on land and requires 1/3 of land more to complete their needs than mother earth provides” (United Nations, 1992). Population Development and Environmental Exploitation Below are listed a number of the effects of population development and environmental exploitation by human populations.

1. Loss of crop lands, forest lands, wetlands for industrial expansion and extraction of minerals use.
2. Fragmenting diversity and wildlife habitats.

3. Increasing impermeable surfaces means more flooding.
4. More resources extraction, manufacturing and consumption.
5. Destruction of habitat due to change of temperature and adaptation in food chain.
6. Extinction of different flora and fauna of different area and some species become endangered due to loss of habitat and disturbance in their food chain and environmental benefits like availability of medicinal plants, fire wood, sandal wood, etc. a. Economic loss. b. Health impacts. c. Social disruption.
7. Change in global climate leads to increase the temperature of earth which in turn leads to polar ice melting, rise in sea level, ice cap melting, decrease in biodiversity, change in temperature of earth, etc.
8. Burning of fossil fuel leads to air pollution and overexploitation of available resources

3.4 Land Use Conversion

Use of land for different purposes of an area at a given time and space is land use. Land is used under different land use pattern like agricultural land, forest, fallow land etc. It is also used as cultivation of crops, building of houses, roads, railways, industries, grazing of animals, etc. The percentage of land used for various purposes differs from one region to another. The land use pattern is regulated by interaction of abiotic factors, such as relief, soil climatic conditions, minerals resources, etc. and the human density of population and the technological and social requirement of the people. Almost all human activities related to food, shelter and clothing takes place on land. Land use is categorised by, actions, the measures and contributions of people in a certain land cover type to cultivate change or maintain it. The availability of land on earth is limited. There is conflict over access and rights of these natural resources. It has also resulted in tough competition between the agriculture and other sectors over usage of land. Moreover, land also suffers from various problems such as soil erosion, degradation and deforestation.

Worldwide changes to forests, farmlands, resources of water and air need to determine to provide, water, food, fibre and shelter for individuals present on earth. World’s plantations, croplands, pastures and increase in urban area, associated with large increases in natural resources and fertiliser consumption, along with considerable biodiversity loss. Population increases in developing countries has produced stress on land, fragmentation of land holding, fisheries, forests, change in temperatures, biodiversity loss etc. Global warming

due to increasing consumption of fossil fuels could have harmful impacts on the populous coastal regions in countries (developing). We face the challenge to make balance between instant needs of human and conserving the capability of the biosphere to provide goods and services for future. Practices for the food production, land use pattern change, over utilisation of natural resources, development of urban area, industrial development, and change in methods of utilisation are few reasons which make more complex relationship between population and land use. Land on the basis of land use pattern is broadly categorised in following form:

1. Agricultural lands
2. Forests
3. Non- agricultural use of land
4. Barren and uncultivated lands
5. Permanent Pasture and other Grazing Land
6. Miscellaneous cash crops and groves
7. Cultivable wasteland
8. Fallow lands, other than current fallows
9. Current fallows
10. Roads, Dams, streams, lakes, building different infrastructure like schools, colleges, hospitals, government buildings, etc.

The global land area is 13.2 billion ha. Of this, 12% (1.6 billion ha) is currently in use for cultivation, 28% (3.7 billion ha) include in forest, and 35% (4.6 billion ha) includes grasslands and forest ecosystems and about 22% of land covered by low income countries (Fischer et al., 2010). As the population grows, the land use pattern also changes. There is transition of land use types to other type of land.

3.5 Rural – Urban Development

Urbanisation is estimated to continue well into the next century. By 2030, it is expected that nearly 5 billion (61%) of 8.1 billion people of the world will stay in cities (FAO, 2000). The modern trend toward urbanisation presumably brings with it, and is accelerated by, the economic advantages of division of labour, specialisation of knowledge, skills and abilities, and multiplication of goods and services. As these advantages are realised, the requirement of moving persons, goods and ideas among establishments increases. Mobility becomes an index of progress and some of the limitations upon growth. Population growth of urban has gone beyond the development of:

- Basic services

- Household services
- Sewerage and solid waste disposal
- Increasing waste generation at home
- Water supply
- Offices and industries, together with unplanned waste disposal facilities which consequence increased environmental deterioration.

There is increasing air pollution by automobiles. Ecology and health affected by this polluted environment. Poverty continues in metropolitan and peri-urban areas; awareness about the glaring inequities in close urban setting may lead to social unrest. Instead of harmful impact of urbanisation on global warming, acid rain and ozone depletion, it has serious influence on the available arable land and subsequently leading to deforestation in maximum part of world. It is contended that decrease resources risks like water table lower down, soil nutrients declining etc. are also higher in the cities because of huge demand of food, water and fuel and disposal of municipal and other wastes are not only logistically difficult, however also a resource-consuming exercise. Although the efficiency of present agriculture and the connected reduce cost of foods are positive for consumers, farmers with small lands, mainly individuals on marginal lands, are frequently affected by large-scale agriculture. This is stimulating rural–urban migration. The modernisation of agriculture and rural–urban migration increases the shift in the mode of production of food and the abandonment of agriculture at marginal land and land available for grazing that favour restoration of ecosystem with spontaneous processes and by enabling the construction of secure areas or conservation policies

4.0 CONCLUSION

The needs of every individual are dependent on the environment. For this we modify our environment and extract or destroy the resources. Land use pattern also changes with last few years of time period as the population increase. If these land use practices are well planned and sustainable, the problems related to land can be solved. Wasteland can be restored with afforestation and scientific techniques.

- By giving education, awareness to youngsters or teenager would create the required consciousness among them that small families are more efficient. It helps to enable them to attain considerable decline in the size of family, achieve their reproductive goals and improve quality of life.

- Agroforestry joins shrubs and trees with farming and forestry practices to produce more diverse profitable, healthy, fruitful, and conservation land use systems, to fulfil the needs of growing population. It is mandatory to use the available agriculture land for great yield and better production of food. With two or more interacting plant species in a given area, it creates a more complex habitat that can support a wider variety of fauna and biodiversity. Apart from all these benefits, it is also reducing poverty by enhancing the production of timber, wood and other products for consumption and sale, contributing food security, cleaner water through reduced nutrient and soil runoff and also maintain ecological balance. But it uses more soil nutrient and need more attention for production.
- The forest conserves the quality and quantity soil and water in many ways, leaves and branches decrease wind strength, after the absorbing solar radiation, decreases the surface area for evaporation. The canopy growth and the decomposition of plant organic matter like leaves, branches and fruits, etc., by soil fauna and microbes, modify soil quality and components, affect the water penetration and drainage and also increase the fertility of the soil. This process is cost affecting and meet the need of growing population. Water cycle and ecological system are conserved by increase in vegetation cover.
- A healthy ecosystem can mitigate change. With time, the composition of species may change but the ecosystem will still function to withstand life. New species moving into the environment, by increase or decrease in number of existing species, or by evolution over time may alter the ecological condition of the area. Natural resources are usually recycled within an ecosystem and progression can help the population to adapt the concern environment without collapse of the system. The more the biodiversity, more easily the system is able to adjust to changes.

5.0 SUMMARY

The identification of urban environment is central to the provision of basic infrastructure. Urban growth identification, quantification, and the knowledge of rate and trends of growth would help in regional planning with better infrastructure in environmentally sound way which requires analyses of spatial and temporal data. Remote Sensing and Geographic Information System (GIS) are used in order to carry out detailed analyses of patterns of urbanisation which would help in addressing the needs of the present and future needs of a region. This plays a key role

in planning for infrastructure and becomes crucial in regional planning especially when resources are scarce. Unchecked urbanisation is often referred colloquially as sprawl poses serious problems in infrastructure planning and implementation that leads to unforeseen consequences. GIS would help in integrating both spatial and statistical data and generate themes based on various growth trends.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the key ingredients of urban growth?
2. Explain the use of both Remote Sensing and GIS in the analyses of urban growth.
3. Describe the elements of regional planning.

7.0 REFERENCES/FURTHER READING

Freeman, T. W. (1968). *Geography and Planning, Hutchinson*. London: University Library.

Grau, H. R., & Aide, T. M. (2007). Are Rural–Urban Migration And Sustainable Development Compatible In Mountain Systems? *Mountain Research and Development*, 27(2), 119–123. Doi:10.1659/Mrd.0906

Lal, R. (1994). *Method And Guidelines For Assessing Sustainable Use Of Soil And Water Resources in The Tropics*. SMSS Technical Monograph 21. Ohio State University.

Lambin, (2003). *Land Change Science: Observing, Monitoring and Understanding, Trajectories of Change on the Earth's Surface*. London: Springer.

UNDP. (2000). *Human Development Report, United Nations Development Programme.* New York: Oxford University Press.

UNEP. (1992). The World Environment 1972-1992. Two Decades of Challenge in M. K. Tolba et al., (Eds.) London: Chapman & Hall.

United Nations. (1992), *The United Nations Programme Of Action From Rio.* New York: UN.

WHO (1992). *Our Planet, Our Earth, Report of the WHO Commission on Health and Environment*. Geneva: World Health Organisation.

World Bank. (2007). *Agriculture for Development World Development Report 2008.* Washington, DC: World Bank.

World Population Data Sheet. (2011). Washington, DC: Population Reference Bureau.

World Population Prospects. (2003). The 1998 Revision. United Nations; 1998. *World Urbanisation Prospects: The Revision*. New York, NY: United Nations.

MODULE 2 SUSTAINABLE DESIGN

UNIT 1 PRINCIPLES OF URBAN DESIGN

CONTENTS

1.0 INTRODUCTION

Principles of Urban Design is a course that looks to the future as a powerful tool that helps to successfully achieve the aspirations of cities. Urban design is the process of shaping the setting (or public realm) for life in cities, towns and villages. How does the public realm work together with the built form and transportation? In general terms, the public realm (i.e. streets, public squares, parks and open space) influences the type of urban environment we can create. The urban environment has a profound effect on how we live our lives both in our neighbourhoods and the larger city. At its heart, urban design incorporates a "people first" design philosophy. This design approach promotes healthy and socially interactive neighbourhoods that contribute to the economic success of the city. It introduces the Geographical Information System (GIS) as a scientific tool for city design and effective functionality.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- List the three principles of sustainability in urban planning
- Identify the methods of planning that can lead to the reduction of environmental impact of the city
- mention three strategies for humane design that focus on enhancing the coexistence between buildings and the greater environment
- identify the methods of achieving sustainable design and energy conservation.

3.0 MAIN CONTENT

3.1 Principles of Sustainable Design

There are three principles of sustainability in urban planning. *Economy of Resources* is concerned with the reduction, reuse, and recycling of the natural resources that are input to a building. *Life Cycle Design* provides a methodology for analysing the building process and its impact on the environment. *Humane Design* focuses on the interactions between humans and the natural world. These principles can provide a broad awareness of the environmental impact, both local and global, of urban planning. Each of these principles embodies a unique set of strategies. Studying these strategies leads students to more thorough understanding of planner's interaction with the greater environment. This allows them to further disaggregate and analyse specific methods planners can apply to reduce the environmental impact of the city they design.

Principle 1: Economy of resources
By economising resources, the planner reduces the use of non-renewable resources in the design of a city and operation of buildings. There is a continuous flow of resources, natural and manufactured, in and out of a building. This flow begins with the production of building materials and continues throughout the building's life span to create an environment for sustaining human well-being and activities. After a building's useful life, it should turn into components for other buildings.

When examining a building, consider two streams of resource flow. Upstream resources flow into the building as input to the building ecosystem. Downstream, resources flow out of the building as output from the building ecosystem. In a long run, any resources entered into a building ecosystem will eventually come out from it. This is the *law of*

resource flow conservation. For a given resource, its forms before entry to a building and after exit will be different. This transformation from input to output is caused by the many mechanical processes or human interventions rendered to the resources during their use in buildings. The input elements for the building ecosystem are diverse, with various forms, volumes, and environmental implications.

The three strategies for the economy of resources principle are *energy conservation, water conservation,* and *material conservation.* Each focuses on a particular resource necessary for building construction and operation.

Principle 2: Life cycle design

The second principle of sustainable planning is life cycle design (LCD). This "cradle-to-grave" approach recognizes environmental consequences of the entire life cycle of resources, from procurement to return to nature. LCD is based on the notion that a material transmigrates from one form of useful life to another, with no end to its usefulness. For the purpose of conceptual clarity, the life cycle of a building can be categorised into three phases: *pre-building, building,* and *post-building*. These phases are connected, and the boundaries between them are not obvious. The phases can be developed into LCD strategies that focus on minimizing the environmental impact of a building. Analysing the building processes in each of these three phases provides a better understanding of how a building's design, construction, operation, and disposal affect the larger ecosystem.

Principle 3: Humane design

Humane design is the third, and perhaps the most important, principle of sustainable design. While economy of resources and life cycle design deal with efficiency and conservation, humane design is concerned with the liveability of all constituents of the global ecosystem, including plants and wildlife. This principle arises from the humanitarian and altruistic goal of respecting the life and dignity of fellow living organisms. Further examination reveals that this principle is deeply rooted in the need to preserve the chain elements of the ecosystems that allow human survival.

In modern society, more than 70% of a person's lifespan is spent indoors. An essential role of architecture is to provide built environments that sustain occupants' safety, health, physiological comfort, psychological well-being, and productivity. Because environmental quality is intangible, its importance has often been overlooked in the quest for energy and environmental conservation,

which sometimes seemed to mean "shivering in the dark." Compounding the problem, many building designers have been preoccupied with style and form-making, not seriously considering environmental quality in and around their built environments.

Remember the performance factor of design. When a product saves energy, does it perform as well as what it is replacing? And how does it affect the performance of building occupants? For instance, early fluorescent lighting systems were more efficient than their incandescent counterparts. The bulb might save money in annual energy costs. A general rule of thumb in such comparisons is that the annual energy bill of a typical office building amounts to around five hours of employee labour cost; therefore, any building energy conservation strategy that annually reduces productivity by more than five hours per employee defeats its purpose. This is not to say that energy conservation cannot be financially beneficial, just that it should be kept in holistic perspective, taking other pertinent factors into account. The following three strategies for humane design focus on enhancing the coexistence between buildings and the greater environment, and between buildings and their occupants,

a. **Preservation of natural conditions:** A planner should minimise the impact of a building on its local ecosystem (e.g., existing topography, plants and wildlife).

b. **Urban design and site planning:** Neighbourhoods, cities, and entire geographic regions can benefit from cooperative planning to reduce energy and water demands. The result can be a more pleasant urban environment, free of pollution and welcoming to nature.

c. **Human comfort:** Sustainable design need not preclude human comfort. Design should enhance the work and home environments. This can improve productivity, reduce stress, and positively affect health and well-being.

3.2 Methods for Achieving Sustainable Design

The ultimate goal and challenge of sustainable design is to find win-win solutions that provide quantitative, qualitative, physical, and psychological benefits to building users. There are many possibilities for achieving this seemingly difficult goal. The three principles of sustainable design — economy of resources, life cycle design, and humane design — provide a broad awareness of the environment issues

associated with architecture. The strategies within each principle focus on more specific topics. These strategies are intended to foster an understanding of how a building interacts with the internal, local, and global environments.

Economy of resources:
Conserving energy, water, and materials can yield specific design methods that will improve the sustainability of architecture. These methods can be classified as two types:

i. Input-reduction methods reduce the flow of non-renewable resources input to buildings. A building's resource demands are directly related its efficiency in utilizing resources.

ii. Output-management methods reduce environmental pollution by requiring a low level of waste and proper waste management.

a. Energy conservation
Energy conservation is an input-reduction method. The main goal is to reduce consumption of fossil fuels. Buildings consume energy not only in their operation, for heating, lighting and cooling, but also in their construction. The materials used in architecture must be harvested, processed, and transported to the building site. Construction itself often requires large amounts of energy for processes ranging from moving earth to welding.

(i) Energy-Conscious Urban Planning: Cities and neighbourhoods that are energy-conscious are not planned around the automobile, but around public transportation and pedestrian walkways. These cities have zoning laws favourable to mixed-use developments, allowing people to live near their workplaces. Urban sprawl is avoided by encouraging redevelopment of existing sites and the adaptive reuse of old buildings. Climatic conditions determine orientation and clustering. For example, a very cold or very hot and dry climate might require buildings sharing walls to reduce exposed surface area; a hot, humid climate would require widely spaced structures to maximize natural ventilation.

(ii) Energy-Conscious Site Planning: Such planning allows the designer to maximize the use of natural resources on the site. In temperate climates, open southern exposure will encourage passive solar heating; deciduous trees provide shade in summer and solar heat gain in winter. Evergreens planted on the north of a building will protect it from winter winds, improving its energy

efficiency. Buildings can be located relative to water onsite to provide natural cooling in summer.

(iii) *Passive Heating and Cooling:* Solar radiation incident on building surfaces is the most significant energy input to buildings. It provides heat, light, and ultraviolet radiation necessary for photosynthesis. Historically, architects have devised building forms that provide shading in summer and retain heat in winter. This basic requirement is often overlooked in modern building design. Passive solar architecture offers design schemes to control the flow of solar radiation using building structure, so that it may be utilized at a more desirable time of day.

Shading in summer, by plants or overhangs, prevents summer heat gain and the accompanying costs of air-conditioning. The wind, or the flow of air, provides two major benefits: cooling and hygienic effects. Prevailing winds have long been a major factor in urban design. For instance, proposals for Roman city layouts were primarily based on the direction of prevailing winds.

(iv) *Insulation:* High-performance windows and wall insulation prevent both heat gain and loss. Reducing such heat transfer reduces the building's heating and cooling loads and thus its energy consumption. Reduced heating and cooling loads require smaller HVAC equipment, and the initial investment need for the equipment will be smaller.

Aside from these tangible benefits, high-performance windows and wall insulation create more comfortable thermal environments. Due to the insulating properties of the materials, the surface temperatures of windows and walls will be higher in the winter and lower in the summer. The installation of smaller HVAC equipment reduces mechanical noise and increases sonic quality of the indoor space.

(v) *Alternate Sources of Energy:* Solar, wind, water, and geothermal energy systems are all commercially available to reduce or eliminate the need for external energy sources. Electrical and heating requirements can be met by these systems, or combination of systems, in all climates.

(vi) *Day Lighting:* Building and window design that utilizes natural light will lead to conserving electrical lighting energy, shaving

peak electric loads, and reducing cooling energy consumptions. At the same time, day lighting increases the luminous quality of indoor environments, enhancing the psychological wellbeing and productivity of indoor occupants. These qualitative benefits of day lighting can be far more significant than its energy-savings potential.

(vii) *Energy-Efficient Equipment and Appliances*: After construction costs, a building's greatest expense is the cost of operation. Operation costs can even exceed construction costs over a building's lifetime. Careful selection of high efficiency heating, cooling, and ventilation systems becomes critical. The initial price of this equipment may be higher than that of less efficient equipment, but this will be offset by future savings.

Appliances, from refrigerators to computers, not only consume energy, they also give off heat as a result of the inefficient use of electricity. More efficient appliances reduce the costs of electricity and air-conditioning.

(viii) *Choose Materials with Low Embodied Energy:* Building materials vary with respect to how much energy is needed to produce them. The embodied energy of a material attempts to measure the energy that goes into the entire life cycle of building material. For instance, aluminium has a very high embodied energy because of the large amount of electricity that must be used to manufacture it from mined bauxite ore; recycled aluminium requires far less energy to refabricate. By choosing materials with low embodied energy, the overall environmental impact of a building is reduced. Using local materials over imported materials of the same type will save transportation energy.

b. Water conservation

Methods for water conservation may reduce input, output, or both. This is because, conventionally, the water that is supplied to a building and the water that leaves the building as sewage is all treated by municipal water treatment plants. Therefore, a reduction in use also produces a reduction in waste.

(i) *Reuse Water Onsite*

Water consumed in buildings can be classified as two types: gray water and sewage. Gray water is produced by activities such as

hand washing. While it is not of drinking-water quality, it does not need to be treated as nearly as intensively as sewage.

In fact, it can be recycled within a building, perhaps to irrigate ornamental plants or flush toilets. Well-planned plumbing systems facilitate such reuse. In most parts of the world, rainwater falling on buildings has not been considered a useful resource. Buildings are typically designed to keep the rain from the occupants, and the idea of utilizing rain water falling on building surfaces has not been widely explored. Building envelopes, particularly roofs, can become rainwater collecting devices, in combination with cisterns to hold collected water. This water can be used for irrigation or toilet-flushing.

(ii) Reduce Consumption

Water supply systems and fixtures can be selected to reduce consumption and waste. Low-flow faucets and small toilet tanks are now required by code in many areas of the country. Vacuum-assisted and bio composting toilets further reduce water consumption. Bio composting toilets, available on both residential and commercial scales, treat sewage on site, eliminating the need for energy-intensive municipal treatment.

Indigenous landscaping - using plants native to the local ecosystem - will also reduce water consumption. These plants will have adapted to the local rainfall levels, eliminating the need for additional watering. Where watering is needed, the sprinkler heads should be carefully placed and adjusted to avoid watering the sidewalk and street.

c. Materials conservation

The production and consumption of building materials has diverse implications on the local and global environments. Extraction processing, manufacturing, and transporting building materials all cause ecological damage to some extent. There are input and output reduction methods for materials conservation. As with water, some of these methods overlap.

(i) Adapt Existing Buildings to New Uses: One of the most straightforward and effective methods for material conservation are to make use of the resources that already exist in the form of buildings. Most buildings outlive the purpose for which they were designed. Many, if not all, of these buildings can be

converted to new uses at a lower cost than brand-new construction.

(ii) *Incorporate Reclaimed or Recycled Materials:* Buildings that have to be demolished should become the resources for new buildings. Many building materials, such as wood, steel, and glass, are easily recycled into new materials. Some, like brick or windows, can be used whole in the new structure. Furnishing, particularly office partition systems, are also easily moved from one location to another.

(iii) *Use Materials That Can Be Recycled:* During the process of designing the building and selecting the building materials, look for ways to use materials that can themselves be recycled. This preserves the energy embodied in their manufacture.

(iv) *Size Buildings and Systems Properly:* A building that is oversized for its designed purpose, or has oversized systems, will excessively consume materials. When a building is too large or small for the number of people it must contain, its heating, cooling, and ventilation systems, typically sized by square footage, will be inadequate or inefficient.

This method relates directly to the programming and design phases of the architectural process. The client's present and future space needs must be carefully studied to ensure that the resulting building and systems are sized correctly. Architects are encouraged to design around standardised building material sizes as much as possible.

(v) *Reuse Non-Conventional Products as Building Materials:* Building materials from unconventional sources, such as recycled tires, pop bottles, and agricultural waste, are readily available. These products reduce the need for new landfills and have a lower embodied energy that the conventional materials they are designed to replace.

(vi) *Consumer Goods:* All consumer goods eventually lose their original usefulness. The "useful life" quantifies the time of conversion from the useful stage to the loss of original usefulness stage. For instance, a daily newspaper is useful only for one day, a phone book is useful for one year, and a dictionary might be useful for 10 years. The shorter the useful life of consumer goods, the greater the volume of useless goods will result.

Consequently, more architectural considerations will be required for the recycling of short-life consumer goods.

The conventional term for consumer goods that have lost their original usefulness is waste. But waste is or can be a resource for another use. Therefore, in lieu of waste, it is better to use the term "recyclable materials". One way buildings can encourage recycling is to incorporate facilities such as on-site sorting bins.

3.3 Life Cycle Design

Life Cycle Design principle embodies three strategies: pre-building, building, and post-building. These strategies, in turn, can yield specific design methods that will improve the sustainability of architecture. These methods focus mainly on reducing input. Consuming fewer materials lessens the environmental impact of the associated manufacturing processes. This then reduces the eventual output of the building ecosystem.

a. Pre-Building phase

During the Pre-Building Phase, the design of a building and materials selected for it are examined for their environmental impact. The selection of materials is particularly important at this stage: the impact of materials processing can be global and have long-term consequences.

(i) *Use Materials Made From Renewable Resources:* Renewable resources are those that can be grown or harvested at a rate that exceeds the rate of human consumption. Using these materials is, by definition, sustainable. Materials made from non-renewable materials (petroleum, metals, etc.) are, ultimately, not sustainable, even if current supplies are adequate. Using renewable materials wherever possible reduces the need for non-renewable materials.

(ii) *Use Materials Harvested or Extracted Without Causing Ecological Damage:* Of the renewable materials available, not all can be obtained without significant environmental effects. Therefore, the architect must be aware of how various raw materials are harvested and understand the local and global ramifications.

(iii) *Use Recycled Materials:* Using recycle materials reduces waste and saves scarce landfill space. Recycled materials also preserve

the embodied energy of their original form, which would otherwise be wasted. This also reduces the consumption of materials made from virgin natural resources. Many building materials, particularly steel, are easily recycled, eliminating the need for more mining and milling operations.

(iv) *Use Materials with Long Life and Low Maintenance:* Durable materials last longer and require less maintenance with harsh cleansers. This reduces the consumption of raw materials needed to make replacements and the amount of landfill space taken by discarded products. It also means occupants receive less exposure to irritating chemicals used in the installation and maintenance of materials.

b. Building phase

The methods associated with the Building Phase strategy are concerned with the environmental impact of actual construction and operation processes.

(i) *Minimize Site Impact:* Careful planning can minimize invasion of heavy equipment and the accompanying ecosystem damage to the site. Excavations should not alter the flow of groundwater through the site. Finished structures should respect site topology and existing drainage. Trees and vegetation should only be removed when absolutely necessary for access. For sensitive sites, materials that can be hand-carried to the site reduce the need for excessive road-building and heavy trucks.

(ii) *Employ Nontoxic Materials:* The use of nontoxic materials is vital to the health of the building's occupants, who typically spend more than three quarters of their time indoors. Adhesives used to make many common building materials can outgas — release volatile organic compounds into the air — for years after the original construction. Maintenance with nontoxic cleansers is also important, as the cleaners are often airborne and stay within a building's ventilation system for an extended period of time.

c. Post-building phase

During this phase, the architect examines the environmental consequences of structures that have outlived their usefulness. At this point, there are three possibilities in a building's future: reuse, recycling of components, and disposal. Reuse and recycling allow a building to become a resource for new buildings or consumer goods; disposal requires incineration or

landfill dumping, contributing to an already overburdened waste stream.

(i) *Reuse the Building:* The embodied energy of a building is considerable. It includes not only the sum of energy embodied in the materials, but also the energy that went into the building's construction. If the building can be adapted to new uses, this energy will be conserved. Where complete reuse of a building is not possible, individual components can be selected for reuse - windows, doors, bricks, and interior fixtures are all excellent candidates.

(ii) *Recycle Materials:* Recycling materials from a building can often be difficult due to the difficulty in separating different substances from one another. Some materials, like glass and aluminium, must be scavenged from the building by hand. Steel can easily be separated from rubble by magnets. Concrete can be crushed and used as aggregate in new pours.

(iii) *Reuse Existing Buildings and Infrastructure:* It has become common for new suburbs to move farther and farther from the core city as people search for "space" and "nature." Of course, the development of new suburbs from virgin land or fertile agricultural fields destroys the very qualities these suburbanites are seeking. Moreover, in addition to the materials for new houses, new development requires massive investments in material for roads, sewers, and the businesses that inevitability follow. Meanwhile, vacant land and abandoned structures in the city, with its existing infrastructure, go unused, materials wasted.

3.4 Humane Design

The Humane Design Principle embodies three strategies: preservation of natural conditions, urban design and site planning, and design for human comfort. These strategies, in turn, yield specific design methods that will improve the sustainability of urban planning. These methods focus primarily on improving the quality of life for humans and other species living in the city.

4.0 CONCLUSION

The methods associated with the Urban Design and Site Planning strategy apply sustainability at a scale larger than the individual building. Sustainable design on an urban scale must be designed to

promote public transportation. Thousands of individual vehicles moving in and out of area with the daily commute create smog, congest traffic, and require parking spaces. Sustainable development encourages the mixing of residential, commercial, office and retail space. People then have the option of living near where they work and shop. This provides a greater sense of community than conventional suburbs. The potential for 24-hour activity also makes an area safer.

5.0 SUMMARY

The course that looks to the future as a powerful tool that helps to successfully achieve the aspirations of cities. The course teaches the process of shaping the setting of urban environment: It seeks to provide answers to the following questions: how does the public realm work together with the built form and transportation? How has the provision of infrastructure influence the type of urban environment? How has the urban environment been affecting the way people live and the city? At its heart, Urban Design incorporates a "people first" design philosophy. It introduces the Geographical Information System (GIS) as a scientific tool for city design and effective functionality.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the three principles of sustainability in urban planning?
2. Examine the Principle of Economy of Resources as they affect they are reflected in energy, water and material conservation.
3. Explain the major ways by which sustainable design are achieved in cities.

7.0 REFERENCES/FURTHER READING

Collins, J.C. (2001). *Good to Great: Why Some Companies Make the Leap–and Others Don't.* Harper Business.

Doppelt, B. (2003*). Leading Change toward Sustainability: A Change-Management Guide for Business, Government and Civil Society*. Greenleaf Publishing.

Doppelt, B. (2008). *The Power of Sustainable Thinking*, Earthscan.

Hamilton, M. (2008). *Integral City: Evolutionary Intelligences for the Human Hive.* New Society Publishers.

James, S. & Philip, B. H. (2007). *Swamp Yankee Planning for Sustainability – A Bottom-Up Process for Becoming an Eco-Municipality*. Cambridge & Newton.

Kotter, J. P. (1996). *Leading Change*. Harvard Business Press.

McDonough, W. (2002). *Cradle-to-Cradle: Remaking the Way we make Things.* North Point Press.

UNIT 2 SUSTAINABLE PLANNING FRAMEWORK

CONTENTS

1.0 INTRODUCTION

The course **Sustainable Planning Framework** provides an overview of community transformation change process. It further teaches additional tools, concept and metrics for sustainable development, and the change process. It analyses the size, geography, infrastructure and culture at different points in their sustainability journeys. It lays out the key phases of an ICSP process overall, and shows how it is flexible, scalable which can be adjusted to suit community "readiness". The course provides a variety of engagement options for different phases to show how it can work in different scales in different communities.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- explain the concept of Integrated Community Sustainability Process (ICSP)
- understand the processes of community transformation
- determine the tools, concepts and metrics of sustainable development
- explain the size, geography, infrastructure and culture of different communities
- understand the governance and sustainable decision-making.

3.0 MAIN CONTENT

3.1 Integrated Community Sustainability Process (ICSP)

While the past century has brought extraordinary improvements in human health and medicine, public education and material well-being, the unintended side effects of our progress have been the destruction of ecosystems, the undermining of human needs and a way of life that cannot continue for much longer. The consequence of living beyond the planet's means is that ecosystems are being run down, resources are disappearing and waste is accumulating in the air, land and water. The resulting impacts – such as clean water shortages and climate change – are putting the well-being and development of all nations at risk.

A simple way of visualising these challenges is to picture a funnel. The walls of the funnel represent the increasing pressures on us - our growing demand for resources and ecosystem services, the declining capacity of the earth to provide those resources and services, stricter governmental laws and consumer pressure and the social tensions resulting from abuses of power and inequality. The most important element of this metaphor is the systematic nature of the pressures we face. There are many different problems, but the overall trend is that these problems are becoming increasingly common and increasingly severe because they are a direct result of the way our society grows and develops.

The sustainability challenge is to avoid 'hitting the walls' while reducing the pressures so the funnel can open up again. For communities, the funnel phenomenon may manifest itself in a wide array of challenges - from rising costs for energy and waste disposal, to exposure to new risks associated with changing weather patterns, to increasing demands on social services and infrastructure. Community sustainability planning is about *transformative* change … as well as incremental improvements. It is about a new way of thinking, making decisions and collaborating. It's a long-term process that requires leadership, shared commitment, hard work and sustained effort. Leaders and stakeholders need to think about their communities as systems, and be ready to embrace change if they are to advance the practice of sustainability. Integrated community sustainability planning is the perfect opportunity for a community to do so.

3.2 Tool, Concepts and Metrics for Sustainable Development

a. ICSP framework and phases

There are numerous ways that a community may organise itself to produce the deliverables of an ICSP outlined in the figure in the previous section, depending on the situation in the community. This guide therefore presents different process and engagement options - all with the same overall framework in mind - so that communities can design an ICSP process that is desirable and appropriate for them. The Natural Step's experience suggests that no matter what the process a community ultimately decides to use, certain key elements should be undertaken to some extent. These key process elements are presented as "Phases" in the table on page 19. The community must decide, however, on the appropriate level of engagement and scope of activity for each phase in its context.

Phase I. The Invitation The decision by a community to undertake a sustainability planning process is generally preceded by a series of interactions among community members that raise awareness about sustainability and its relevance to the community and build support for the idea of sustainability planning. Often, these interactions begin with one individual or a small group of concerned individuals, who may be members of Council, members of the public or municipal staff. This individual or group acknowledges the sustainability challenges facing the community and undertakes to raise awareness and build support for the need for sustainability planning. Such efforts that have been most successful are those that combine facts and knowledge about sustainability with an "invitation" to other community members to explore together their relevance to the community.

Desired outcomes
Community leaders, stakeholders and/or the community at large are engaged in a discussion(s) about the community's future, aware of the relevance of sustainability to the community, and have developed a shared sense of the need for community sustainability planning.
The level of interest (or readiness) amongst community leaders, stakeholders and/or the community at large for collaborating on a community sustainability planning process is understood.

Phase II Structuring the Process There is no one way to undertake an ICSP process and each community will tackle it differently. The structure of your process should therefore reflect the community's level

of interest and readiness for participating in and committing to integrated community sustainability planning.

Desired Outcomes

A preferred sustainability planning approach for your community has been decided upon and committed to.

All key stakeholders have had an opportunity to contribute to the structuring of the ICSP process. The roles and responsibilities of various contributors to the ICSP process have been clarified in the form of a project governance plan.

***Phase III*.** Community Visioning Being strategic requires having a clear understanding of success, of where one wants to be. This is the essence of back casting. Many communities use the concept of a "vision statement" to define success at the highest level. The primary purpose of a community vision is to unite the community around a shared statement of purpose and core values. It should be future focused and act as a functional benchmark providing direction for all aspects of the community into the future. Having a strong shared vision of what a community wants is absolutely critical. However, simply developing a well-articulated vision statement is not enough. The most successful efforts build a shared sense of purpose, commitment and intent. So, think about the visioning element of your community's ICSP as an opportunity to begin the process of building a shared intention in the community to achieve a sustainable future.

Building shared intention through community visioning requires a process that both helps community members articulate their aspirations for the future **and** helps develop a deeper understanding within the community of what is required for a sustainable future. While this section focuses primarily on the high-level vision, there is a strong connection between the high-level vision and the descriptions of success for each key community system described in *Phase IV* on "Understanding the Sustainability Gap for Key Community Systems" p. 39, which provide a more robust expression of the desired future. Together, these two key deliverables help build a clearer sense within the community of where it wants to and needs to be in a sustainable future.

Desired outcome

A shared understanding of success for the community in a sustainable future and a shared intention to create that future has been developed amongst community members.

***Phase IV*.** Understanding the Sustainability Gap for Key Community Systems Sustainability isn't just about how far a community has come or even where it is heading. A community needs to understand the gap between where it is today and where it wants to be in a successful, sustainable future. The tension established by this "sustainability gap" is fundamental to the creativity and innovation necessary to find new ways forward. This part of the process involves identifying community systems that must be addressed to achieve the vision and developing "descriptions of success" (i.e. how that system would look like if the vision was achieved) and "descriptions of current reality" (i.e. how that system looks today). Using the sustainability principles to frame both steps helps ensure that the description of success falls within the constraints of a sustainable future and that the assessment of current reality is rigorous and complete. Together these help us understand the sustainability gap.

***Phase V*.** Understanding the Sustainability Gap for Key Community Systems one of the key challenges of this step is how to ensure both comprehensiveness *and* integration. A comprehensive approach to sustainable community planning requires that all aspects of a community be considered. An integrated approach to sustainable community planning requires that these various aspects not be considered in isolation from each other. The key to achieving both comprehensiveness and integration is to use the same framework and process for the review of all community systems and to identify strategies that synergistically support transitions in different community systems. This cross-system fertilisation can be explicitly designed into an engagement process.

Desired outcomes
A determination has been made about which key community systems (e.g. energy, food, etc…) need to be addressed in order to achieve sustainability and the community's vision. A shared understanding of the gap between current reality and a successful, sustainable future has been established for the key community systems. Indicators have been identified that can be used to monitor progress towards success for each key community system.

***Phase VI*.** Identifying Strategies and Initiatives to Bridge the Gap. The process of developing a Description of Success and of analysing the current reality for each community system will have generated a number of ideas for initiatives and investments. The next ICSP phase is the part of the process where the community can dive into these and other ideas with great enthusiasm. It involves engaging community members in the

generation of ideas for strategies, initiatives and investments to move the community from current reality toward success, sorting those ideas into short-term, medium-term and long-term priorities.

Desired outcomes
Short-term, medium-term and long-term strategies, initiatives and investments have been prioritised for integration into business plans and budgets of the municipality and possibly other community partner organisations.

Phase VII. Continuing the journey and monitoring progress Thus far, the focus of this guide has been the process for creating the first draft of an integrated community sustainability plan. However, one of the greatest challenges communities typically face is moving from planning to implementation. Sustainability plans are only successful if they achieve concrete results and become part of the official policies and practices of the community and its partners. They help a community move beyond the creation of the plan by creating a process by which strategies and initiatives can be developed, monitored and modified on an ongoing basis.

Desired outcomes
A governance and partnerships approach has been established to guide the implementation of the ICSP in the community. The initiatives in the ICSP are being implemented in the community. Progress on the implementation of the ICSP is monitored and evaluated.

4.0 CONCLUSION

Sustainability is about ensuring that our children and grandchildren have access to the same or better opportunities in life as we have now. Recycling a little bit more paper or using a little bit less energy in your organisation is a good way to start, but these small changes alone will not be enough. The purpose of this guide is to give you and your team the tools you need to begin creating transformational change within your community. By using this guide to develop an ICSP, your community can take an important step toward a sustainable future. The guide will help you establish a sustainability team with a shared understanding of sustainability will highlight the relevance of sustainability for your community, will help to analyse your community's current reality and aid in the creation of strategic goals and objectives for the future. It lays out a process for brainstorming solutions to achieve these goals and objectives, developing an action plan and capitalising on early wins. As you continue to refine, evaluate and implement your ICSP, you may choose to return to some of the tools and resources provided here to help support you on your journey. Eventually, you can make sustainability as much a part of work and life as health and safety are today.

Imagine yourself five, ten, twenty years down the road. Think of all the early seeds that will have been planted by taking small steps to raise awareness and incorporate sustainability into the fabric of your community. Think of how those seeds will have grown into a forest, and all the extraordinary things your community will do to contribute to the transformation of society. Think of the jobs that will have been created and families supported throughout the course of your community's journey. Think of all the learning that will have occurred – from the successes and failures – that will lead to new, unexpected creative developments within your community. Think of the unparalleled leadership it will have taken to invite co-workers, stakeholders, suppliers, community members and shareholders to the table to participate in an ongoing spiral of meaningful change.

More than ever before, we need leaders like you who care deeply enough to make change happen, even when the obstacles seem great. Your ICSP will help you and your team to identify the challenges your community faces and overcome them one by one. We can create a world that we will be proud of passing on to future generations. Thank you for your leadership, commitment and passion – they will make this future a reality!

5.0 SUMMARY

The world is urbanising at an unprecedented rate, and more than half the world's population live in cities. Predictions indicate that by 2050, two-thirds of the world's 9.8 billion people will live in urban areas. The corresponding increase in global urban land cover during the first three decades of the 21st century is expected to be greater than the cumulative urban expansion before the year 2000 (IPCC 2014). While urbanisation presents many opportunities, rapidly expanding cities face a multitude of perils that come in tandem. Economic disruptions, social strife, and environmental disasters are increasingly occurring within their enlarging boundaries. Such occurrences exert huge stresses on often limited infrastructure and public services. It is often asserted that the battle for sustainable development will be won or lost in cities. Indeed, the world's growing cities are at the leading edge of the global sustainability agenda. How cities choose to respond to challenges can greatly influence the prosperity and quality of life of their residents. City governance and planning initiative failures can exacerbate urban problems—such as socioeconomic inequality, slums and informal settlements, urban sprawl, and the degradation of natural ecosystems—while also exposing the city to the localised effects of global climate change. City governments must therefore make informed decisions

about their infrastructure investments based on up-to-date data sources. It is crucial that cities take advantage of opportunities to enhance sustainability. As they grapple with population growth, advancing rates of urbanisation, and the impacts of climate change, it is clear that in the future, cities will need to adopt innovative approaches to support increasing demands by their residents. Cities can be and must become places of innovation and drivers of economic growth, where wealth and jobs are created and resources are used efficiently. The choices that are made about how cities are built, inhabited, and maintained will have long-term global effects.

The urban sustainability framework has been developed to:

- Help build a common understanding of sustainability within an urban context
- Provide practical guidance to cities on how to pursue urban sustainability through integrated approaches;
- Serve as a policy tool to support cities in collecting and integrating data, and using those data sets to define a vision, set targets, monitor progress, and forecast trends—all while being able to compare themselves with peer cities;
- Establish a common framework to measure urban sustainability so that cities can diagnose and benchmark their current performance; monitor the impacts of their policy and planning interventions, and share data and knowledge with other cities in the GPSC network and beyond.

6.0 TUTOR-MARKED ASSIGNMENT

1. What opportunities are presented by urbanization in the contemporary world?
2. Explain how any city of your choice plan to respond to challenges posed by urbanisation?
3. Describe the approaches through which cities adopt innovative to support increasing demands by residents.
4. Describe the ways by which the Integrated Community Sustainability Process (ICSP) can be implemented and also give the particular desirable outcome achievable at different levels of implementation.

7.0 REFERENCES/FURTHER READING

IPCC (Intergovernmental Panel on Climate Change)(2014). “Human Settlements, Infrastructure and Spatial Planning.” In: *Climate*

Change 2014: Mitigation of Climate Change. Working Group III contribution to the IPCC 5th Assessment Report. Geneva: IPCC. http://www.urbanmorphologyinstitute.org/wp-content/uploads/2014/04/IPCCreport-Chapter-12.pdf.

OECD (Organisation for Economic Co-operation and Development) (2015). "Fostering Investment in Infrastructure." Paris: OECD. https://www.oecd.org/daf/inv/investment-policy/Fostering-Investment-inInfrastructure.pdf.

UN (United Nations) (2011). *Cities and Climate Change: Global Report on Human Settlements* 2011. Nairobi: United Nations Human Settlements Programme. https://unhabitat.org/books/cities-and-climate-change-global-report-on-humansettlements-2011/.

UN (United Nations) (2015a). "Transforming Our World: The 2030 Agenda for Sustainable Development." United Nations General Assembly. http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.

UN (United Nations) (2015b). *World Urbanisation Prospects: The 2014 Revision*. New York: United Nations, Department of Economic and Social Affairs, Population Division. https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf.

UN (United Nations) (2017). "New Urban Agenda." Habitat III Secretariat. http://habitat3.org/wp-content/uploads/NUA-English.pdf.

UN-Habitat and International City Leaders (2015). "The City Prosperity Initiative: 2015 Global City Report." https://unhabitat.org/wp-content/uploads/2016/02-old/CPI_2015%20Global%20City%20Report.compressed.pdf.

World Bank (2013). *Planning, Connecting, and Financing Cities—Now: Priorities for City Leaders.* Washington, DC: World Bank. doi:10.1596/978-0- 8213-9839-5.

MODULE 3 ENVIRONMENTAL SCIENCE AND POLICY

UNIT 1 LAND USE POLICY

CONTENTS

1.0 INTRODUCTION

The course land use policy is associated with conservation, utilisation and allocation of land resources and defined as the official notification of a government's objectives and plans. The objective of the National Land Policy is to promote and ensure secure land tenure system, to encourage the optimal use of land resources and to facilitate broad-based social and economic development without endangering the ecological balance of the environment. In the Course the following shall be clearly described: land related benefits, political choice and forms in relation to allocation of authorities, and user rights of land and related natural resources that exist between the government and original land owners i.e. people of the country. The land policy may for instance include or promote:

- security of tenure
- access to credit
- land reform
- land titling
- resolution of issues relating to traditional or customary tenures
- provision of land for the poor, ethnic minorities and women
- land use and physical planning
- real property taxation

- prevention of land speculation and land disputes

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- the associated usefulness of land use policy in any society
- the major benefit of land use policy
- the land allocation authorities and procedure especially in Nigeria
- the different land reforms carried out in Nigeria

3.0 MAIN CONTENT

3.1 Land Use Policy

Among the sensitive and complicated issues in any nation is the land question. The circumstances under which land ownership passed from one social group to another or from community to private individuals may be complicated. Expropriation of land without compensation, theft, and unfair acquisition by individuals and authorities characterised the pre-independence history of in many countries in Africa. Such expropriation facilitated the concentration of large tracks of land parcels in the hands of a small section of the urban population. In the rural areas during the era, lands were taken away from Africans by few agents who were working for the colonial administrators and merchants dealing in agricultural products. Lack of secure land tenure is among the constraints which inhibit development in communal and even urban areas.

After Independence, each country made effort to establish a coherent national land policy to guide policies within different sectors and stressed the role of the cadastre in this context for:

- legal framework for administering land rights
- supporting structural change
- environmental protection
- sustainable management and control of natural resources and environment
- supporting land markets
- information for planning and monitoring of land use
- implementation of land policies (land consolidation, land disputes, compulsory acquisition of land)

The overall aim of a National Land Policy is to promote and ensure a secure land tenure system, to encourage the optimal use of land resources, and to facilitate broad-based social and economic development without upsetting or endangering the ecological balance of the environment. The specific objectives of this National Land Policy are to:

a. Promote an equitable distribution of and access to land by all citizens.
b. Ensure that existing rights in land especially customary rights of small holders (i.e. peasants and herdsmen who are the majority of the population in the country) are recognized, clarified, and secured in law.
c. Set ceilings on land ownership which will later be translated into statutory: ceilings to prevent or avoid the phenomenon of land concentration (i.e., land grabbing).
d. Ensure that land is put to its most productive use to promote rapid social and economic development of the country.
e. Modify and streamline the existing land management systems and improve the efficiency of land delivery systems.
f. Streamline the institutional arrangements in land administration and land dispute adjudication and also make them more transparent.
g. Promote sound land information management.
h. Protect land resources from degradation for sustainable development.

This range of possible land policy objectives conceals a host of different national approaches, with a range of different experience between different countries on relevant areas of land policy. Notwithstanding this, there are tendencies to restrict the range of possible policy directions in some areas. International agreements may, for example, result in centralising tendencies for policies relating to land. These have tended to be particularly significant when relating to issues such as the environment, which by definition are strongly international. The UN, for example, at the Conference on Environment and Development (UNCED) in 1992 and at the Habitat II conference in 1996 generated statements of policy intent concerning environmental issues relating to land (and coastal and marine) policy. Many such statements may reflect existing practices, or will provide targets that may find their way at least in part into relevant national policies.

Whether or not centralising or harmonising tendencies are relevant to individual areas of policy, it is apparent that all policies are dynamic, whether they are related to land or otherwise. Policies change over time

because the relevant frameworks in which the policies are identified change over time, whether because of changes in political priorities, changes in our understanding of physical processes, or changes in economic parameters.

3.2 Developing the Framework of Land Policy

In overall terms the framework for land policy considers several areas where policies relating to land will be relevant. These include the physical, the economic and fiscal, the social, and the political frameworks as summarised and exemplified in the text boxes in this section. Although these specified areas are considered separately in this section, the reality is that there is very frequently strong interaction between them, and between different measures within them. An example of this in the context of the physical framework is provided by territorial and planning controls which may determine the use of land according to the appropriate basis in the law. Such controls on the use of land will have potentially strong economic and fiscal impacts. Use and the statutorily defined use of the land will be a significant factor in determining its value in terms of capital and rental value in the market. This in turn may well affect the ability of an owner to raise capital against the security of the land, and hence appropriately finance the business on the land. There may also be impacts on the taxation value of the land, depending upon how this is defined in law.

The economic and fiscal framework covers the wide variety of economic policies ranging from the fundamental, whether the economy will run on a market economy based approach or a centrally planned approach, through to the sector specific, such as what and how agricultural support policies will be implemented. Both have major implications for land policy. For the examples given, the former determines the state's view on land (as land) ownership, with the normal centrally planned view being that the land belongs to the state and cannot be owned by individuals. The implications, as the transitional economies are currently experiencing, of moving to a market economy view where land may be privately owned, are enormous, and have repercussions in physical, social and political frameworks. As regards the latter, agricultural support policies will feed through into higher agricultural land prices, which will distort economic decision-making.

Economic and fiscal framework	**Physical framework**
The economic and fiscal framework for land policy typically will include those measures affecting the economic and fiscal environment that have an impact on land. These will include for example: • Market economy v central planning/social provision policies • Taxation policies • Agricultural support policies • Urban action area support policies • Real property as security for lending	The physical framework for land policy typically will include those measures affecting the physical environment. These will include for example: • Building regulations/controls • Territorial/planning controls • Environmental controls

Within the economic and fiscal frameworks there will also be interactions that need to be considered. When considering changes in taxation policy all aspects of taxation policy need to be considered together. In many countries there are moves towards market value based taxes on land (and buildings) which cannot be looked at in isolation from how the land market works in the specific circumstances of the country in question, nor from how proposed new taxes will impact upon those liable in view of their overall tax burdens.

In the physical context, the move to private ownership of land in the political and economic frameworks of the transitional economies gives rise to the need to reconsider existing approaches to land administration. The typical orientation of land and buildings related agencies in the former socialist economies was horizontal, dividing the land from the buildings. That of the market economies is more typically vertical, with land and buildings typically being owned and treated as a unity. This affects both the administrative structures and how, for example, physical planning will be regarded and carried out.

3.3 Land Use Administration

National land resource management shall be taken into consideration not only for the present but also for the future in order to enhance people's food security, water resource development, improvement of transportation, economic and business development, and protection of environment and cultural heritage. In land resource administration, it is important to develop and apply correct and complete policy, reliable legal framework and competent land management systems that are resulted from analysis of economical, political, legal and social aspects of the country.

National land use policy is associated with conservation, utilisation and allocation of land resources and defined as the official notification of a government's objectives and plans. In the policy, it shall be clearly described land related benefits, political choice and forms in relation to allocation of authorities, and user rights of land and related natural resources that exist between the government and original land owners i.e. people of the country.

National land use policy is normally laid down with various objectives including land ownership and tenure security, equitable allocation, productivity for investment, sustainable environmental conservation, and enjoyment of natural beauty. In the implementation of land use policy, it is required to have systematic land management system in order to approve record and distribute land ownership, land tenure, land value and land use information. Some of currently used land resource laws and administration are over hundred year old. It shall be reviewed in order to ensure that they are in line with current situations; possessing ability to carry out public benefits and equality.

3.4 Land Types and Classification

Land use is the surface utilisation of all developed and vacant land on a specific point, at a given time and space. According to the FAO concept, land use defines the human activities which are directly related to land, making use of its resources, or having an impact on them. In that context the emphasis is on the function or purpose for which the land is used and particular reference is made to "the management of land to meet human needs" (FAO, 1976). Jasbir Singh and Dillon (2005) define land use of an area as "the cumulative outcome of the historical events, the interaction of the economic forces with the natural environment and natural value of the society". Land use thus automatically involves the concepts of optimizing the land use potential, land evaluation for

example, and of land use planning. A distinction should be made here between present land use (the way in which the land is used at present) and potential land use (how it could be used with or without improvements). The land use pattern of a region is an outcome of natural and socio – economic factors which decide the utilisation of land by man over time and space. It is basically a function of four variables land, water, air and man. Each plays its own role in composing its life history. The efficient use of land depends on the capacity of man to utilise the land and to manage it. Land use may vary in nature and in intensity according to the purpose it serves – whether it is food production, recreation, or mining – and the biophysical characteristics of the land itself. The use of land has intensified with the increase of population, method and technology. The use to which land is put is determined by the owners, farmers, institutions of Governments as the case may be, according to their perception as to the needs. Such decisions are influenced by a large number of factors of physical and cultural aspects.

Land use classification is of great significance in land use analysis. Land use classification is the systematic arrangement of various classes of land on the basis of certain similar characteristics, mainly to identify and understand their fundamental utilities, intelligently and effectively in satisfying the needs of human society. The best use of each parcel of land requires a scientific and methodologically appreciable classification. This may help us in investigating the land use problems and be the basis of planning for the best use of our land after considering the major land use categories. According to Barnes (1936) the objectives of land use classification can be categorised into the following.

- To give more enlightened and economically sound land settlement policies both public and private.
- Guidance in public land purchase and development.
- Planning the organisation and distribution of local government services
- Guidance in the distribution of public aids
- Guidance in determining sound real estate lending and borrowing policies.
- Land assessment for taxation purposes.
- Developing administration programmes for land conservation and management
- Developing sound farm management policies and organizing the most effective Decide the type and size of operative units.

The prime requisite for better land use planning is information on existing land use and their spatial distribution. The present land use is related to landform, climate, soil conditions, irrigation facilities, marketing and socio-economic conditions. The best use of each parcel of land requires a scientific and methodologically appreciable classification of the present land use. This could be achieved only though the proper understanding of existing land uses pattern and changes that have taken place in concerned regions. Land classification is not an end in itself but a means of obtaining better land use.

3.5 Urban Land Information Management

Governments are entrusted with the stewardship of land to ensure that it is equitably exploited amongst a diverse set of users without compromising the ability of future generations to meet their own needs for land. Decisions to support the sustainable development of this land, as a valuable and finite resource, merit a holistic approach to impact assessment. Many aspects and options need to be explored to arrive at an appropriate, objective decision. This can only be achieved if the decision makers, both city officials and citizens, have access to consistent and integrated information about land. A key element in providing this relevant land information is City-wide Land Information Management (LIM), the institutional and technical arrangements whereby information about all land and real property within a city are administered. Cities currently manage considerable collections of land related information. However, the traditional separation of this information into different component themes combined with disjoint information management regimes, leads to a considerable loss in the value of the information as a resource. City-wide LIM provides the means to technically and institutionally integrate these component themes of land information into a truly corporate information resource.

Achieving the Urban Land Information Management (LIM) requires careful consideration of the following 10 Commandments applicable to all cities, independent of status, location and affluence:

1. Understand the vision of sustainable development – ensure that all stakeholders in the management of land understand sustainable development principles and the role of City-wide LIM in supporting more effective decision making through the provision of integrated land information.
2. Appoint a Single Responsible Officer – City-wide LIM involves considerable interdepartmental co-operation. This will only work

if there is a Single Responsible Officer with clear authority for delivering City-wide LIM.

3. Clarify the role of each stakeholder in implementing the common City-wide LIM vision – all stakeholders, at the political, service delivery and citizen levels, must fully understand their roles and responsibilities in implementing their component parts of the common City-wide LIM vision.
4. Obtain political support – success is dependent on political backing. Short 'proof of concept' projects aligned with current political issues and an effective communication strategy will secure support at the highest level within the city.
5. Comply with national land policy – the City-wide LIM must operate within, and effectively support, the corresponding national legal, institutional and fiscal frameworks.
6. Implement good governance of LIM – manage information as a resource just like as human and financial resources. Good governance of LIM will inextricably lead to good governance of land.
7. Ensure that the implementation is business / user led – the priorities for implementing a City-wide LIM must be led by real business / user needs and deliver clear benefits to the city (improved decision making and efficiencies) and to citizens (engaging them in decision making).
8. Prepare an information inventory – an analysis of business requirements for a Citywide LIM will identify information needs. A subsequent inventory of existing and missing information will form the basis for planning a City-wide LIM, clearly identifying standards, procedures and custodians for information management.
9. Underpin operations with sustained capacity building – success of City-wide LIM is dependent on appropriate human resources. A programme of continued capacity building is required at technical and management levels (strong project management culture) and not just short term training
10. Ensure that there is continuing investment – City-wide LIM is an on-going programme requiring continuing investment to renew and improve technology and resources and to continually maintain information.

4.0 CONCLUSION

Fundamentally land occupies space. It extends over an area. However it does not possess same characteristics in all its areal extent. There are varied combinations of physical, socio-cultural and economic

parameters. Hence land possesses innumerable permutation combinations and their arrangement over the space is a matter of great importance for the advancement and sustenance of human society. This spatial variation or areal differentiation is the basic domain of geographical research. Thus geographers view land as the foundation on which man has organised himself in various forms of society. Even though land is a finite resource, the demand for this scarce resource is increasing along with the alarming growth of human population. The combination of population growth, limited expansion of arable land and the growing need for land for non-agricultural purposes increases the pressure on – and competition for – the available space. The advances in science and technology also should read along with this. Consequently no other resource on the earth is put to overuse, misuse, abuse and even underuse than land. The land surface and its inherent production potential are under continuous threat due to a variety of natural degradation processes and human-induced (mis)management. The ever-increasing pressure on land calls up on the need for scientific and judicious use of every piece of land. The pressure on existing land resource should be tackled effectively. This could be achieved only through developing various strategies for the optimal and sustainable utilisation of this finite resource. Consequently, land use planning has attained very much significance. The information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population.

5.0 SUMMARY

Land use Policy promotes and ensures secure land tenure system, and also encourages the optimal use of land resources and to facilitate broad-based social and economic development without endangering the ecological balance of the environment. Changes in land use and the increase in human population over the last two and half decades have increased the demand for land and competition for plots especially in and around major urban centres. Increased urbanisation around countries in Africa especially, requiring more land for settlements, industries and commerce etc. has intensified competition for land in and around urban centres over the last 30 years. The recent upsurge of prospective investors wishing to acquire large pieces of land in various parts of the urban areas in response to investment promotion policy around the continent has increased competition for urban land and increased conflicts with other resource users especially in the peri-urban areas.

Increasing awareness amongst the population of the value of land and property (buildings) also cause land conflicts in, especially, urban areas, as more people compete for the limited number of demarcated plots each year or for land acquired through purchase, inheritance, or allocation by the local leadership. Land markets are developing in and around urban centres and require recognition and regulation to enable the government to capture gains from land market transactions. New economic and social policies and uncertainty in land rights calls for different approach for protecting land rights of individuals and organisations to ensure continuity. These factors call for a comprehensive policy which would not only guide the allocation, ownership and use of land but also help resolve any recurring land conflicts.

6.0 TUTOR-MARKED ASSIGNMENT

1. Identify and explain any five land use policy objectives that target and encourage the optimal use of land resources especially in urban areas.
2. Examine in the physical, economic, social, political and fiscal frameworks for land policy and show how they holistically influence land use policy in any country in Africa.
3. Explain how the systematic land management system can effectively ease access to land and its effective utilisation in urban areas.
4. What is the relevance of land use classification in land use analysis?

7.0 REFERENCES/FURTHER READING

Douglas, I. (1983). *The Urban Environment*, London, Edward Arnold.

ECTP (1998). 'The New Charter of Athens 1998: European Council of Town Planners' Principles for Planning Cities', http://www.ceu-ectp.org/en/athens.html

Exline, C. H. Peters, G. L. & Larkin, R. P. (1982). *The City: Patterns and Process in Urban Ecosystems*. Boulder: Colorado, Westview Press.

Fitzpatrick, K. & LaGory, M. (2000). *Unhealthy Places: The Ecology of Risk in the Urban Landscape*. New York: Routledge.

Gilbert, O. L. (1989). *The Ecology of Urban Habitats*, New York: Chapman and Hall.

Grove, J. M. & Burch, W. R. (1997). "A Social Ecology Approach and Application of Urban Ecosystem and Landscape Analyses: A Case Study of Baltimore,

Howe, E. (1994). Acting on Ethics in City Planning. New Brunswick: NJ: CUPR Rutgers the State University of New Jersey.

Kjellen, M. (2001). *The Citizens at Risk: From Urban Sanitation to Sustainable Cities*. London: Earthscan Publications.

Lo Piccolo, F. & Thomas, H. (2001). 'Legal Discourse, the Individual and the Claim for Equality in British Planning', Planning Theory & Practice 2(2): 187–201.

Moore, T. (1978). 'Why Allow Planners to Do What They Do? A Justification from Economic Theory', *Journal of the American Institute of Planners* 44(4): 387–98.

Nozick, R. (1974). *Anarchy, State and Utopia*. New York: Basic Books.

Perera, V. (1997). The Cross and the Pear Tree: A Sephardic Journey. London: Flamingo-Harper Collins

Sassen, S, (1991). *The Global City: New York. London: Tokyo*, Princeton, Princeton University Press.

Vasishth, A. & Slone, D. C. (2002). "Returning to Ecology: An Ecosystems Approach to Understanding the City" in Dear, M J (ed) *Chicago to LA: Making Sense of Urban Theory*, Thousand Oaks, Sage Publications.

UNIT 2 SCIENCE IN POLICY PROCESS

CONTENTS

1.0 INTRODUCTION

The course **Science in the Policy Process** teaches the science of policy development. It analyses 'system' in thinking and its impacts. It categorises policy, and examined the policy-making process. Topics of importance include: decision-making process; policy analysis; policy intervention; policy-making models; and types of decisions and resources available.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- understand the science behind thinking and the impact
- explain the policy-making problem
- explain the policy making process, policy intervention and policy-making models
- describe policy making in the public sector.

3.0 MAIN CONTENT

3.1 Policy Development Processes

Policy-making has been defined as the process by which governments translate their political vision into programmes and actions to deliver 'outcomes' – desired change in the real world. Policy can take a range of different forms, including non-intervention; regulation, for instance

by licensing; or the encouragement of voluntary change, including by grant aid; as well as direct public service provision.
The process of policy-making is not a high science, but it is difficult a process. There are tools and techniques that can help in doing the job more effectively. Public policy operates in an extremely wide environment. Governments have obligations to, and are answerable to, every part of civic society. Policy-making often requires a department or the administration as a whole to strike a balance among a wide range of competing interests without losing sight of the desired policy outcome.

The world for which policies have to be developed is becoming increasingly complex, uncertain and unpredictable. Citizens are better informed, have rising expectations and are making growing demands for services tailored to their individual needs. Key policy issues, such as social need, low educational achievement and poor health, are connected and cannot be tackled effectively by departments or agencies acting individually. In addition, devolution introduces a system of government which is designed to be more joined-up and responsive.

3.2 Systems Thinking and Impact

The world is undergoing rapid changes. The future is uncertain. Policymakers are faced with policy alternatives that are often numerous, diverse and produce multiple consequences that are far-reaching yet difficult to anticipate (let alone predict). Different groups perceive and value different consequences differently. Nevertheless, public policymakers have a responsibility to develop and implement policies that have the best chance of contributing to the health, safety and well-being of their constituencies. Given this context, policymaking is not easy. Uncertainties abound. Data are limited. Simply identifying the key policy issues is a difficult task and one does not have the luxury of ignoring certain topics because they are too messy or intractable. However, without analysis, important policy choices are based on hunches and guesses - sometimes with regrettable results. Over the past 50 years, policy analysts have developed a systems-based approach and a set of tools for examining public policy issues that illuminate the uncertainties and their implications for policymaking, that identify tradeoffs among the alternative policies and that support the policymaking process.

3.3 The Policy-Making Process

Policymaking involves a combination of processes. Although not always clear-cut or easily distinguishable, political scientists have identified these processes for purposes of analysis. They include the following:

a. Identifying policy problems: Publicised demands for government action can lead to identification of policy problems. Many factors influence the identification of policy problems. They include the methods of getting issues on the political agenda as well as keeping them off the agenda. Political ideology and special interests, the mass media, and public opinion all play roles in problem identification. Agenda Setting "Agenda setting," that is, deciding what is to be decided, is the first critical step in the policymaking process. To get on the agenda, problems must come to policymakers' attention. Some problems-even major problems-are too "invisible" to make the agenda, while others such as healthcare, is already highly visible, because they affect us all. Other times, crises or "focusing events" (e.g., drought in northern Nigeria) are needed to bring problems to light.

b. Formulating policy proposals: Policy proposals can be formulated through political channels by policy-planning organizations, interest groups, government bureaucracies, state legislatures, and the president and Congress. John Kingdon likens the processes of formulating and selecting policy alternatives to a process of "biological natural selection":

> "Many ideas are possible in principle, and float around in a "policy primeval soup" in which specialists try out their ideas in a variety of ways—bill introductions, speeches, testimony, papers, and conversation. . . . [These] proposals . . . come into contact with one another, are revised and combined . . . , and floated again. But the proposals that survive to that status of serious consideration meet several criteria, including their technical feasibility, their fit with dominant values and the current national mood, their budgetary workability, and the political support or opposition they might experience".

Policy-planning organisations, interest groups, government bureaucracies, state legislatures, and the president and Congress may all engage in formulating policy proposals. Since neither Congress nor state legislatures can continuously attend to all policy issues, policymaking is often done in relative obscurity by

groups of specialists that may be called iron triangles, policy subsystems, or issue networks, but some policy issues do "catch fire." "Average citizens" certainly have policy preferences, but in most areas of governments, policy is highly complex and generally requires the efforts of those whose careers are devoted to particular policy subsystems.

c. Legitimising public policy: Policy is legitimised as a result of the public statements or actions of government officials, both elected and appointed in all branches and at all levels. This includes executive orders, budgets, laws and appropriations, rules and regulations, and decisions and interpretations that have the effect of setting policy directions. Policy is legitimised as a result of the public statements or actions of government officials, both elected and appointed—the president, Congress, state legislators, agency officials, and the courts. This includes executive orders, budgets, laws and appropriations, rules and regulations, and administrative and court decisions that set policy directions. Nations found that as problems are being identified and certain policy proposals float to the top, the political climate-the current national mood, interest group pressure or lack of pressure, and who is in office-must all converge for a proposal to be adopted. These forces may serendipitously align to produce such a "policy window," but policy entrepreneurs try to seize the opportunity to bring these forces to bear for a new policy or a policy change to occur.

d. Implementing public policy: Policy is implemented through the activities of public bureaucracies and the expenditure of public funds. Policy implementation includes all the activities that result from the official adoption of a policy. Policy implementation is what happens after a law is passed. We should never assume that the passage of a law is the end of the policymaking process. Sometimes laws are passed and nothing happens! Sometimes laws are passed and executive agencies, presuming to act under these laws, do a great deal more than Congress ever intended. Traditionally, public policy implementation was the subject matter of public administration. The separation of "politics" from "administration" was once thought to be the cornerstone of a scientific approach to administration. But today it is clear that politics and administration cannot be separated. Opponents of policies do not end their opposition after a law is passed. They continue their opposition in the implementation phase of the policy process by opposing attempts to organise, fund, staff, regulate, direct, and coordinate the program. If opponents are

unsuccessful in delaying or halting programs in implementation, they may seek to delay or halt them in endless court battles (school desegregation and abortion policy are certainly cases in point). In short, conflict is a continuing activity in policy implementation.

e. Evaluating public policy: Policies are formally and informally evaluated by government agencies, by outside consultants, by interest groups, by the mass media, and by the public. Over the years, increasing numbers of formal evaluations of social policies have been conducted. Governments, especially the federal government, have spent millions of dollars to determine whether the policies and programs they have initiated are having effects. In discussing these studies in the chapters that follow, it is evident that program evaluations can produce their own political fallout. There may be disagreements about study methodology, and people with different views will interpret the same study results differently. Policy evaluations can be helpful to policymakers, but they usually do not solve political controversies or change deeply held values.

Although these stages or phases approach to policymaking has been criticized for being too simplistic, insufficiently explicating that some phases may occur together, and not saying much about why policy turns out as it does, it does provide a way to discuss many of the ways policy is constructed, carried out, evaluated, and made again. All these activities include both attempts at rational problem solving and political conflict.

3.4 Policy-Analysis

Policy analysis has its roots in operations research. It evolved from operations research (in the late 1940s and early 1950s) through systems analysis (in the late 1950s and early 1960s) to policy analysis in problem-oriented work for governments carried out at the RAND Corporation and other applied research organisations in the 1960s and 1970s. Miser (1980) and Majone (1985) describe this evolution. In the beginning, operations research techniques were applied to problems in which there were few parameters and a clearly defined single objective function to be optimised. Gradually, the problems being analysed became broader and the contexts more complex.

Single objectives were replaced by the need to consider tradeoffs among multiple (and conflicting) objectives (e.g. the impacts on health, the

economy and the environment, and the distributional impacts on different social or economic groups). Non-quantifiable and subjective considerations had to be considered in the analysis. Optimisation was replaced by satisficing. Simon (1969, pp. 64–65) defined satisficing to mean finding an acceptable or satisfactory solution to a problem instead of an optimal solution. He said that satisficing was necessary because 'in the real world we usually do not have a choice between satisfactory and optimal solutions, for we only rarely have a method of finding the optimum'. Uncertainty became a more important element in the analysis. And the tools (and their associated disciplines) needed to deal with the increased breadth and uncertainty expanded from an initial focus on mathematical modelling to include surveys, focus groups, scenario development and gaming.

The policy analysis process has been applied to a wide variety of problems. Miser and Quade (1985, ch. 3) provide examples of some of these, including improving blood availability and utilization, improving fire protection, protecting an estuary from flooding, and providing energy for the future. More generally, the policy analysis approach has been used in the formulation of policies at the national level, including national security policies, transportation policies and water management policies.

Public policy analysis is a rational, systematic approach to making policy choices in the public sector. It is a process that generates information on the consequences that would follow the adoption of various policies. It uses a variety of tools to develop this information and to present it to the parties involved in the policymaking process in a manner that helps them come to a decision. It is more an art than a science since 'it draws on intuition as much as on method' (Bardach, 1996, p. 1). And, as Heineman et al. (1990) state: 'As long as human dignity and meaning exist as important values, social science cannot achieve the rigor of the physical sciences because it is impossible to separate human beliefs from the context and process of analysis'. Nevertheless, policy analysis uses the scientific method. This means that the work is open and explicit, the work is objective and empirically based, the work is consistent with existing knowledge, and the results are verifiable and reproducible. Its purpose is to assist policymakers in choosing a course of action from among complex alternatives under uncertain conditions. The word 'assist' emphasizes that policy analysis is used by policymakers as a decision aid, just as check lists, advisors and horoscopes can be used as decision aids. Policy analysis is not meant to replace the judgment of the policymakers (any more than an X-ray or a blood test is meant to replace the judgment of medical doctors).

Rather, the goal is to provide a better basis for the exercise of that judgment by helping to clarify the problem, presenting the alternatives and comparing their consequences in terms of the relevant costs and benefits. The word 'complex' means that the policy being examined deals with a system that includes people, social structures, portions of nature, equipment and organisations.

Policy analysis is performed in government, at all levels; in independent policy research institutions, both for-profit and not-for-profit; and in various consulting firms. It is not a way of solving a specific problem, but is a general approach to problem solving. It is not a specific methodology, but it makes use of a variety of methodologies (including multicriteria decision analysis) in the context of a generic framework. Most important, it is a process, each step of which is critical to the success of a study and must be linked to the policymakers, to other stakeholders and to the policymaking process. The approach is built around an integral system description of a policy field. At the heart of the system description is a system model (not necessarily a computer model) that represents the policy domain. The system model clarifies the system by (1) defining its boundaries and (2) defining its structure — the elements and the links, flows and relationships among them.

3.5 The Steps of Policy Analysis

The policy analysis process generally involves performing the same set of logical steps. Most projects include only a subset of the steps. The steps are not always performed in the same order and there is usually feedback among the steps. The steps are summarised below:

Step 1: Identify the problem. This step sets the boundaries for what follows. It involves identifying the questions or issues involved, fixing the context within which the issues are to be analysed and the policies will have to function, clarifying constraints on possible courses of action, identifying the people who will be affected by the policy decision, discovering the major operative factors and deciding on the initial approach.

Step 2: Identify the objectives of the new policy. Loosely speaking, a policy is a set of actions taken to solve a problem. The policymaker has certain objectives that, if met, would 'solve' the problem. In this step, the policy objectives are determined. (Most public policy problems involve multiple objectives, some of which conflict with others).

Step 3: Decide on criteria (measures of performance and cost) with which to evaluate alternative policies. Determining the degree to which a policy meets an objective involves measurement. This step involves identifying consequences of a policy that can be estimated (quantitatively or qualitatively) and that are directly related to the objectives. It also involves identifying the costs (negative benefits) that would be produced by a policy and how they are to be estimated.

Step 4: Select the alternative policies to be evaluated. This step specifies the policies whose consequences are to be estimated. It is important to include as many as stand any chance of being worthwhile. If a policy is not included in this step, it will never be examined, so there is no way of knowing how good it may be. The current policy should be included as the 'base case' in order to determine how much of an improvement can be expected from the other alternatives.

Step 5: Analyse each alternative. This means determining the consequences that are likely to follow if the alternative is actually implemented, where the consequences are measured in terms of the criteria chosen in Step 3. This step usually involves using a model or models of the system. The step is usually performed for each of several possible future worlds (scenarios).

Step 6: Compare the alternatives in terms of projected costs and effects. This step involves examining the estimated costs and effects for each of the scenarios, making tradeoffs among them and choosing a preferred alternative (which is robust against the possible futures). If none of the alternatives examined so far is good enough to be implemented (or if new aspects of the problem have been found, or the analysis has led to new alternatives), return to Step 4.

Step 7: Implement the chosen alternative. This step involves obtaining acceptance of the new procedures (both within and outside the government), training people to use them and performing other tasks to put the policy into effect.

Step 8: Monitor and evaluate the results. This step is necessary to make sure that the policy is actually accomplishing its intended objectives. If it is not, the policy may have to be modified or a new study performed.

Having, briefly described all 8 steps, it is important to state that Steps 1–3 are probably the most important in the entire process. Together, they can be referred to as 'formulating the problem'. The remainder of the steps can be referred to as 'solving the problem'. Russell Ackoff once

said: “We fail more often because we solve the wrong problem than because we get the wrong solution to the right problem”. This means that a great deal of effort should be devoted to these three steps. In fact, some of the projects RAND Europe carry out deal exclusively with these three steps and the projects are viewed by the client as being very successful. Often, however, analysts give these steps short shrift. Many times, the problem statement given to the analyst is accepted without question.

4.0 CONCLUSION

Policy, a way by which, governments translate their political vision into programmes and actions to deliver 'outcomes' do not evolve out of nothing. They are guided by the science of thinking. There are tools and techniques that can help in doing the job effectively. Public policy operates in an extremely wide environment. Governments have obligations to, and are answerable to, every part of civic society. Policy-making often requires a department or the administration as a whole to strike a balance among a wide range of competing interests without losing sight of the desired policy outcome. Policy can take a range of different forms, including non-intervention; regulation, for instance by licensing; or the encouragement of voluntary change, including by grant aid; as well as direct public service provision.The world for which policies have to be developed is becoming increasingly complex, uncertain and unpredictable. Citizens are better informed, have rising expectations and are making growing demands for services tailored to their individual needs. Key policy issues, such as social need, low educational achievement and poor health, are connected and cannot be tackled effectively by departments or agencies acting individually. In addition, devolution introduces a system of government which is designed to be more joined-up and responsive

5.0 SUMMARY

Politics intervenes at every stage of the policymaking process. Many energetic lobbies and political action committees in the United States work to influence elected officials every day. Politicians’ work is difficult because the values espoused by competing interest groups often differ widely. When it comes to social welfare policy, Americans represent the political spectrum from conservatives to middle-of-the-road centrists to liberals. This diversity of opinion causes the country to pursue a pluralist approach to social welfare policymaking. Policymakers follow several lines of thinking and arrive at policies and programs that are often contradictory and overlapping because they try

to see that there is something there for everyone. Social welfare policy development and implementation are much more a political "art and craft"36 than a rational science. It is not enough for human service professionals to know the needs of people and to want to pass policies and provide services to help them. Policy advocates for the disenfranchised must both understand the political process and be adept at working within it if they are to have a voice in shaping social policy.

6.0 TUTOR-MARKED ASSIGNMENT

1. Identify and explain the tools and techniques that can help in the process of policy-making.
2. How does the system of thinking translate into the science of policy making?
3. What are the stages involved in the policy making process?
4. Public policy analysis is a rational, systematic approach to making policy choices in the public sector. Examine the statement.

7.0 REFERENCES/FURTHER READING

Bruce, R.A. (1995). *Decision Making Style: The Development and Assessment of a New Measure.* Educ Psychol Manag 55:818–831

Eppinger B., Nystrom L.E. & Cohen J.D. (2012). Reduced Sensitivity to Immediate Reward during Decision-Making in Older Than Younger Adults. Pubmed, 7(5). In: *Samanezlarkin GR (2013) Financial Decision-Making and the Aging Brain*. Assoc J Psychol Sci Observer, 26(5), 30–33

Kholi, A. (1989). Determinants of Influence in Organisational Buying: A Contingency Approach. J Mark 7(1):50–65

Löckenhoff, C.E. (2011). Age, Time, and Decision Making: From Processing Speed to Global Time Horizons. Annual New York Academy of Science, 1235:44–56. In: *Samanez-Larkin GR (2013) Financial Decision-Making and the Aging Brain*. Assoc Psychol Sci Observer 26 (5):30–33.

Oliveira, A. (2007). *A Discussion of Rational and Psychological Decision Making Theories and Models: The Search for a Cultural Ethical Decision Making Model*. Electron J Bus Electron J Bus Ethics Org Stud 12(2):12–17.

Rotter, J.B. (1966). *Generalised Expectancies for Internal Versus External Control of Reinforcements*. Psychol Monogr 80(1):1–28, Whole No. 609

Russ, F.A., Mcneilly K.M. & Comer J.M. (1996). *Leadership, Decision-Making And Performance Of Sales Managers: A Multi-Level Approach.* J Pers Sell Sales Manag XVI (3):1–15.

Samanez-Larkin, G.R., Mata, R., Radu, P.T., Ballard, I.C., Carstensen L.L. & Mcclure, S.M. (2011) Age Differences in Striatal Delay Sensitivity During Inter-Temporal Choice. In: *Healthy Adults*. Front Neurosci 5:126 Sen A (2008) The Discipline Of Economics. Economic, 75 (300):617–628

Scott, J. (2000). *Understanding Contemporary Society: Theories of the Present.* Sage Publications, London Scott SG.

Uzonwanne, F.C. (2016). Influence of Age and Gender on Decision-Making Models and Leadership Styles of Non-Profit Executives in Texas, USA. Int J Organ Analysis 24(2):186–203. *Emerald Insight*

UNIT 3 ENERGY, PLANNING AND BUILT-ENVIRONMENT

CONTENTS

1.0 INTRODUCTION

The course **Energy, Planning and Built-Environment** is developed to show to energy management has significant impact on planning within local or regional scale. The Course analyses the consequences of the implementation of large-scale renewable energy source that involves multifaceted analyses, evaluation of environmental impacts, and the assessment of the scale of limitations or exclusions imposed on potential urbanized structures and arable land. The Course further shows that the process of site designation involves environmental transformations, which further includes several key issues, e.g. emissions, hazards for nature and/or inhabitants of urbanized zones. The parameters of potential development of energy-related infrastructure of facility acquire its local properties – the generic development data require adjustment, which is site specific or area specific.

2.0 OBJECTIVES

By the end of this unit, you will be able to:

- identify energy types and their sources
- understand the importance of the use of renewable energy in urban centres
- explain the environmental consequences of the use of various sources of energy in the city.

3.0 MAIN CONTENT

3.1 Energy types and Sources

Energy comes in different forms and one form can be converted to another. For example, if we drop a plate from a height, the potential energy of the plate is converted mostly to sound energy when it hits the ground. If we light a candle, the process is highly exothermic so that the chemical energy in the wax is converted to heat energy and light energy on burning. What other products are obtained when we burn a candle? The total energy during a physical or chemical process remains the same. In our daily lives we use energy from various sources for doing work. We use diesel to run our generators. We use electricity to light our streets and houses. Or we use energy in our muscles to cycle to school. The muscular energy for carrying out physical work, electrical energy for running various appliances, chemical energy for cooking food or running a vehicle all come from some source. We need to know how to select the source needed for obtaining the energy in its usable form. Some of these sources are conventional.

3.2 Conventional Sources of Energy

a. **Fossil fuels:** In ancient times, wood was the most common source of heat energy. The energy of flowing water and wind was also used for limited activities. The exploitation of coal as a source of energy made the industrial revolution possible. Increasing industrialisation has led to a better quality of life all over the world. It has also caused the global demand for energy to grow at a tremendous rate. The growing demand for energy was largely met by the fossil fuels – coal and petroleum. Our technologies were also developed for using these energy sources. But these fuels were formed over millions of years ago and there are only limited reserves. The fossil fuels are non-renewable sources of energy, so we need to conserve them. If we were to continue consuming these sources at such alarming rates, we would soon run out of energy! In order to avoid this, alternate sources of energy were explored. But we continue to be largely dependent on fossil fuels for most of our energy requirements. Burning fossil fuels has other disadvantages too; they cause air pollution.

The oxides of carbon, nitrogen and sulphur that are released on burning fossil fuels are acidic oxides. These lead to acid rain

which affects our water and soil resources. In addition to the problem of air pollution, recall the green-house effect of gases like carbon dioxide. The pollution caused by burning fossil fuels can be somewhat reduced by increasing the efficiency of the combustion process and using various techniques to reduce the escape of harmful gases and ashes into the surroundings. Besides being used directly for various purposes – in gas stoves and vehicles, do you know fossil fuels are the major fuels used for generating electricity?

b. **Thermal power plant:** Large amount of fossil fuels are burnt every day in power stations to heat up water to produce steam which further runs the turbine to generate electricity. The transmission of electricity is more efficient than transporting coal or petroleum over the same distance. Therefore, many thermal power plants are set up near coal or oil fields. The term thermal power plant is used since fuel is burnt to produce heat energy which is converted into electrical energy.

c. **Hydro power plants:** Another traditional source of energy was the kinetic energy of flowing water or the potential energy of water at a height. Hydro power plants convert the potential energy of falling water into electricity. Since there are very few water-falls which could be used as a source of potential energy, hydro power plants are associated with dams. In the last century, a large number of dams were built all over the world. In Nigeria, Kanji and many other smaller dams are known to produce hydro-electricity.

d. **Bio-mass energy:** Wood has been used as a fuel for a long time. If we can ensure that enough trees are planted, a continuous supply of fire-wood can be assured. You must also be familiar with the use of cow-dung cakes as a fuel. Since these fuels are plant and animal products, the source of these fuels is said to be bio-mass. These fuels, however, do not produce much heat on burning and a lot of smoke is given out when they are burnt. Therefore, technological inputs to improve the efficiency of these fuels are necessary. When wood is burnt in a limited supply of oxygen, water and volatile materials present in it get removed and charcoal is left behind as the residue. Charcoal burns without flames, is comparatively smokeless and has higher heat generation efficiency. Similarly, cow-dung, various plant materials like the residue after harvesting the crops, vegetable

waste and sewage are decomposed in the absence of oxygen to give bio-gas.

e. **Bio-gas plant:** The plant has a dome-like structure built with bricks. Slurry of cow-dung and water is made in the mixing tank from where it is fed into the digester. The digester is a sealed chamber in which there is no oxygen. Anaerobic micro-organisms that do not require oxygen decompose or break down complex compounds of the cow-dung slurry. It takes a few days for the decomposition process to be complete and generate gases like methane, carbon dioxide, hydrogen and hydrogen sulphide. The bio-gas is stored in the gas tank above the digester from which they are drawn through pipes for use. Bio-gas is an excellent fuel as it contains up to 75% methane. It burns without smoke, leaves no residue like ash in wood, charcoal and coal burning. Its heating capacity is high. Bio-gas is also used for lighting. The slurry left behind is removed periodically and used as excellent manure, rich in nitrogen and phosphorous. The large-scale utilisation of bio-waste and sewage material provides a safe and efficient method of waste-disposal besides supplying energy and manure.

3.3 Non-Conventional (or Alternative) Sources of Energy

With technological progress, our demand for energy increases day by day. Our life-styles are also changing; we use machines to do more and more of our tasks. Our basic requirements are also increasing as industrialisation improves our living standards. As our demand for energy increases, we need to look for more and more sources of energy. We could develop the technology to use the available or known sources of energy more efficiently and also look to new sources of energy. Any new source of energy we seek to exploit would need specific devices developed with that source in mind. We shall now look at some of the latest sources of energy that we seek to tap, and the technology designed to capture and store energy from that source.

a. **Solar energy:** The Sun has been radiating an enormous amount of energy at the present rate for nearly 5 billion years and will continue radiating at that rate for about 5 billion years more. Only a small part of solar energy reaches the outer layer of the earth's atmosphere. Nearly half of it is absorbed while passing through the atmosphere and the rest reaches the earth's surface.

A black surface absorbs more heat as compared to a white or a reflecting surface under identical conditions. Solar cookers and solar water heaters use this property in their working. Some solar cookers achieve a higher temperature by using mirrors to focus the rays of the Sun. Solar cookers are covered with a glass plate. It is easy to see that these devices are useful only at certain times during the day. This limitation of using solar energy is overcome by using solar cells that convert solar energy into electricity. A typical cell develops a voltage of 0.5–1 V and can produce about 0.7 W of electricity when exposed to the Sun. A large number of solar cells are, combined in an arrangement called solar cell panel that can deliver enough electricity for practical use. The principal advantages associated with solar cells are that they have no moving parts, require little maintenance and work quite satisfactorily without the use of any focussing device. Another advantage is that they can be set up in remote and inaccessible hamlets or very sparsely inhabited areas in which laying of a power transmission line may be expensive and not commercially viable. Silicon, which is used for making solar cells, is abundant in nature but availability of the special grade silicon for making solar cells is limited. The entire process of manufacture is still very expensive, silver used for interconnection of the cells in the panel further adds to the cost. In spite of the high cost and low efficiency, solar cells are used for many scientific and technological applications.

b. **Energy from the sea-tidal energy:** Due to the gravitational pull of mainly the moon on the spinning earth, the level of water in the sea rises and falls. If you live near the sea or ever travel to some place near the sea, try and observe how the sea-level changes during the day. This phenomenon is called high and low tides and the difference in sea-levels gives us tidal energy. Tidal energy is harnessed by constructing a dam across a narrow opening to the sea. A turbine fixed at the opening of the dam converts tidal energy to electricity. As you can guess, the locations where such dams can be built are limited. Wave Energy Similarly, the kinetic energy possessed by huge waves near the seashore can be trapped in a similar manner to generate electricity. The waves are generated by strong winds blowing across the sea. Wave energy would be a viable proposition only where waves are very strong. A wide variety of devices have been developed to trap wave energy for rotation of turbine and production of electricity.

c. **Ocean thermal energy:** The water at the surface of the sea or ocean is heated by the Sun while the water in deeper sections is relatively cold. This difference in temperature is exploited to obtain energy in ocean-thermal-energy conversion plants. These plants can operate if the temperature difference between the water at the surface and water at depths up to 2 km is 20 K (20°C) or more. The warm surface-water is used to boil a volatile liquid like ammonia. The vapours of the liquid are then used to run the turbine of generator. The cold water from the depth of the ocean is pumped up and to condense vapour again to liquid. The energy potential from the sea (tidal energy, wave energy and ocean thermal energy) is quite large, but efficient commercial exploitation is difficult.

d. **Geothermal energy:** Due to geological changes, molten rocks formed in the deeper hot regions of earth's crust are pushed upward and trapped in certain regions called 'hot spots'. When underground water comes in contact with the hot spot, steam is generated. Sometimes hot water from that region finds outlets at the surface. Such outlets are known as hot springs. The steam trapped in rocks is routed through a pipe to a turbine and used to generate electricity. The cost of production would not be much, but there are very few commercially viable sites where such energy can be exploited. There are number of power plants based on geothermal energy that are operational in New Zealand and United States of America.

e. **Nuclear energy:** How is nuclear energy generated? In a process called nuclear fission, the nucleus of a heavy atom (such as uranium, plutonium or thorium), when bombarded with low-energy neutrons, can be split apart into lighter nuclei. When this is done, a tremendous amount of energy is released if the mass of the original nucleus is just a little more than the sum of the masses of the individual products. The fission of an atom of uranium, for example, produces 10 million times the energy produced by the combustion of an atom of carbon from coal. In a nuclear reactor designed for electric power generation, such nuclear 'fuel' can be part of a self-sustaining fission chain reaction that releases energy at a controlled rate. The released energy can be used to produce steam and further generate electricity.

The major hazard of nuclear power generation is the storage and disposal of spent or used fuels – the uranium still decaying into harmful

subatomic particles (radiations). Improper nuclear-waste storage and disposal result in environmental contamination. Further, there is a risk of accidental leakage of nuclear radiation. The high cost of installation of a nuclear power plant, high risk of environmental contamination and limited availability of uranium makes large-scale use of nuclear energy prohibitive. Nuclear energy was first used for destructive purposes before nuclear power stations were designed. The fundamental physics of the fission chain reaction in a nuclear weapon is similar to the physics of a controlled nuclear reactor, but the two types of device are engineered quite differently.

3.4 Environmental Consequences

We have studied various sources of energy in the previous sections. Exploiting any source of energy disturbs the environment in some way or the other. In any given situation, the source we would choose depends on factors such as the ease of extracting energy from that source, the economics of extracting energy from the source, the efficiency of the technology available and the environmental damage that will be caused by using that source. Though we talk of 'clean' fuels, it would be more exact to say that a particular source is cleaner than the other. We have already seen that burning fossil fuels causes air pollution. In some cases, the actual operation of a device like the solar cell may be pollution-free, but the assembly of the device would have caused some environmental damage. Research continues in these areas to produce longer lasting devices that will cause less damage throughout their life.

4.0 CONCLUSION

Energy comes in different forms and from both conventional and unconventional sources. We use energy from all the sources for all activities. In a built-environment use of energy from some sources can cause environmental blights. The source we would choose depends on factors such as the ease of extracting energy from that source, the economics of extracting energy from the source, the efficiency of the technology available and the environmental damage that will be caused by using that source. For most urban societies it is recommended that we use 'clean' fuels in order to generate energy as the continued burning of fossil fuels can cause air pollution.

5.0 SUMMARY

Our energy requirements increase with our standard of living. In order to fulfil our energy requirements, we try to improve the efficiency of

energy usage and also try and exploit new sources of energy. We also need to look for new sources of energy because the conventional sources of energy like fossil fuels are in danger of getting exhausted soon. The energy source we select would depend on factors like the ease and cost of extracting energy from the source, the efficiency of the technology available for using that source of energy and the environmental impact of using that source. Many of the sources ultimately derive their energy from the Sun.

6.0 TUTOR-MARKED ASSIGNMENT

1. Name two energy sources that you would consider to be renewable. Give reasons for your choices.
2. Give the names of two energy sources that you would consider to be exhaustible. Give reasons for your choices.
3. Identify and explain any five energy types and sources in your city and examine the environmental consequences of each of them.

7.0 REFERENCES/FURTHER READING

Barelkowski, R.. (2012). The Edge of the [dis]order. (Eds.). *The Sustainable City VII. Urban Regeneration and Sustainability*. (Eds.). M. Pacetti, G. Passerini, C.A. Brebbia & G. Latini, Wessex Institute of Technology. WIT Press: Southampton & Boston, pp. 764–765. doi: http://dx.doi.org/10.2495/sc120642.

Barelkowski, R.. (2013). Sustainability – Myth, Reality, and Future. Planning and Renewable Energy Management, *The Sustainable City VIII. Urban Regeneration and Sustainability*. (Eds.). S.S. Zubir & C.A. Brebbia, Wessex Institute of Technology, WIT Press, Southampton & Boston, pp. 792–793, doi: http://dx.doi.org/10.2495/sc130662.

Chowdhury, S., Zhang, J., Messac, A. & Castillo, L. (2011). Characterising The Influence of Land Configuration on the Optimal Wind Farm Performance, Multidisciplinary Design and Optimisation Laboratory, *ASME 2011 International Design Engineering Technical Conferences, and Computer and Information in Engineering Conference*, Washington, DC, p.3, doi: http://dx.doi.org/10.1115/detc2011-48731.

Meyers, J. & Meneveau, C. (2011). Optimal Turbine Spacing in Fully Developed Wind-Farm Boundary Levels, *Wind Energy*, **15**, Pp. 314–315, Doi: Http://Dx.Doi.Org/10.1002/We.469.

Rogers, J., Slegers, N. & Costello, M., (2011). A Method for Defining Wind Turbine Setback Standards, *Wind Energy*, **15(2)**, Pp. 289–303,. doi: http://dx.doi.org/10.1002/we.468.