

Developing Appropriate Theories for Tropical Eco-Settlement: Ecological Approach

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Introduction

- ★ Studying settlements and urban ecology can be approached by a diverse field of research that forms a continuum from “pure” ecology in the settlement and urban setting to a combination of ecology and social sciences to examine urban and settlement environmental systems

Introduction

- ★ Thus settlements and urban ecological research may emphasize societal or natural sciences, and often seeks to apply research results to settlement planning and management.
- ★ There is a need for urban ecology to converge with human ecology, if the collective goal is to achieve global ecological sustainability in global growing cities and built environment. The geographical scale of research is often relatively large, spanning a neighborhood, settlements, city and its surroundings.

Introduction

- ★ The approach adopted in the paper draws from the latter strand of studies and departs from the ecological science and adopted ecosystems concept as the main approach.
 - Such an approach centered on the applicability of ecosystem analytical methods and describes the interrelationships of sub-ecosystems and species as well as the ecological transformations.

Settlement

- ★ Settlements ecology may be understood simply as ecological research done in settlements environments.
- ★ There are many definitions of “settlement”. One of the settlement definitions is any form of human habitation, from a single dwelling to the largest city. Basically, it is a geographical term characterizing the land use of an area.

Ecology

- ★ Although **ecology** is a natural science concerned with the distribution and abundance of organisms, the word has many **other meanings** as well.
- ★ Rebele (1994) divided **ecological research in the urban setting** into two broad types: **social sciences oriented and ecology oriented**.
 - Traditionally, these two approaches to urban ecology have been independent and sectoral (Wittig and Sukopp, 1993). However, it appears that the integration of these two approaches would benefit both parties (Blood, 1994; Rees, 1997).

Ecology of settlements and urban ecosystems

The effects of human actions on ecosystems into three types:
McDonnell and Pickett (1993)

- ★ **The “bad”** effects are obvious negative phenomena such as toxic waste spills, which have been well studied by ecologists.
- ★ **The “subtle”** effects include a variety of inconspicuous or indirect interactions of humans with ecosystems.
- ★ **The “good”** effects are directly associated with areas populated by humans, and are labeled “good”, not because all effects of human habitation are ecologically good, but because concentrations of people are apparently socially desirable by humans.

Ecology of settlements and urban ecosystems

- ★ Settlement and urban landscapes can serve as field experiments for addressing both basic ecological questions and issues related to the ecological effects of humans on their environment (World Bank 2005, Haila and Levins, 1992; McDonnell and Pickett, 1990).
 - The study of settlements and urban systems could provide ecological insight into the good, the bad, and the subtle effects of humans on ecosystems that could help minimize the harmful effects of urbanization and settlements expansion on other species and ultimately on humans themselves.

Distinctive characteristics of settlements and urban ecosystems

- ★ It is evident that settlement and urban ecosystems are strongly affected by humans, but is the degree of human influence the only difference between settlement, urban and non-urban ecosystems?
- ★ “urban ecosystems differ from their ‘natural’ counterparts solely in the degree of man’s influence.”
- ★ Other urban ecologists agree (e.g., Gilbert, 1989; Sukopp and Numata, 1995; Walbridge 1997).
- ★ Invasion by alien species is more common in urban than in non-urban conditions (Elton, 1958; Spence and Spence, 1988).

Distinctive characteristics of settlements and urban ecosystems

Differences in ecological processes between urban and non-urban environments is an especially useful approach for urban ecological research, and planning and management of green areas.

Trepl (1995) proposed three main properties distinguishing settlements and urban landscapes from non-urban ones that merit research:

- ★ patchiness of urban ecosystems and poor connectivity among them,
- ★ succession, and
- ★ invasion by alien species.

In addition to these, the question of ecological scale needs to be considered when investigating settlements and urban landscapes, especially for the attributes of species diversity patterns.

Patchiness or territoriality of settlements and urban ecosystems

- ★ In settlements as in cities generally, habitat patches are often small and isolated from each other by a matrix of built environment.
- ★ Specific ecological theories that can be used as a framework for examining ecological patterns and processes in such urban “archipelagoes” include island biogeography theory (MacArthur and Wilson, 1967) and metapopulation theory (Hanski and Simberloff, 1997).

Patchiness or territoriality of settlements and urban ecosystems

- ★ the theory may serve as a first exploration of the relationship between species richness and characteristics of settlements and urban habitat patches,
 - ★ but useful ecological information for planners and managers must include more than species richness estimates.

Patchiness or territoriality of settlements and urban ecosystems

- ★ The metapopulation theory has not been tested in settlements and urban landscapes yet, but it appears to provide a promising framework for settlements and urban ecological studies.
 - ★ Connectivity of settlements and urban habitat patches can be enhanced by creating movement corridors and greenways. However, as noted by Noss (1993), greenways and corridors should not substitute for the protection of large area.

Patchiness or territoriality of settlements and urban ecosystems

- ★ Ecological research in the urban setting may be divided into two broad types: social sciences oriented and ecology oriented. Rebele (1994)
 - ★ Traditionally, these two approaches to urban ecology have been independent and sectoral (Wittig and Sukopp, 1993). However, it appears that the integration of these two approaches would benefit both parties (Blood, 1994; Rees, 1997).

Invasion, extinction, and succession in settlements and urban ecosystems

- ★ Increased travel and cultivation of exotic species have increased the frequency of species introductions and invasions into settlements and urban areas (Rebele, 1994).
 - Successful invasions by alien species are more common in strongly human-modified habitats than in more natural habitats (Spence and Spence, 1988; Rapoport, 1993).
 - In addition to invasion, frequent local extinctions maintain variation in species composition among urban habitat patches (Rebele, 1994).

Invasion, extinction, and succession in settlements and urban ecosystems

- ★ Another typical feature of urban habitats is their early successional stage, which is maintained by disturbance, such as regular mowing of parks. Furthermore, successional development is highly variable in urban green spaces.
 - Even adjacent patches may exhibit very different successional paths depending on the colonization history of plants, which is to a great extent determined by chance events (Gilbert, 1989).

A theory of settlements and urban ecology: is it necessary?

- ★ A new theory of urban ecology, or at least a framework within which urban ecological research could be conducted, was needed. Trepl (1995). Further needs to be agreed and implemented cooperatively among all agencies involved.
 - Such a theory, or framework, would need to deal with the structure and functioning of settlements and urban ecosystems, i.e., the theory would have to identify the specific features (such as invasion, disturbance) of urban ecosystems, and distinguish them from other ecosystems.

A theory of settlements and urban ecology: is it necessary?

- ★ There are differences between urban and non-urban ecosystems, but the **basic ecological patterns and processes are similar.**
- ★ The main difference seems to be the **relative importance and prevalence of certain processes in settlements and urban as compared to non-urban landscapes.**
 - This being the case, no need exists for a distinct theory of settlements and urban ecology. The existing ecological theories can be applied when studying ecology in the settlements and urban setting. The promising ones are those that address the special features of urban ecosystems (isolation, succession, disturbance) and include the island biogeography theory, the metapopulation theory, and the intermediate disturbance hypothesis.

A theory of settlements and urban ecology: is it necessary?

- ★ A fruitful approach to a holistic view of urban ecosystems is an integration of concepts and approaches satisfying both natural and social scientists, as well as managers.
- ★ A useful approach to combine these elements is the “**human ecosystem model**,” which identifies several social components and processes where connections to ecological fluxes, processes, and structures exist (Pickett et al., 1997).

The human subsystem includes social institutions, social cycles (e.g., physiological, individual, and environmental), and social order

The resources subsystem comprises both

- ★ human resources (cultural and socioeconomic resources) and
- ★ ecosystem resources (ecosystem patterns and processes).

A theory of settlements and urban ecology: is it necessary?

- ★ All the major subsystems are functionally linked. The human ecosystem model provides a framework for settlements and urban ecological studies addressing questions of varying specificity. Nevertheless, the specific ecological theories within the model can be the same for both urban and nonurban areas.

A theory of settlements and urban ecology: is it necessary?

- ★ The urban-to-rural land-use gradient could serve as a model system for the study of the responses of biotic communities to human disturbance
- ★ (Pickett et al. (1997), McDonnell et al., 1997), which can be applied in settlements.

A theory of settlements and urban ecology: is it necessary?

- ★ The idea is to compare sites with the same original physical environment (e.g., forest patches) but differing in measurable features of urbanization from city centers to their rural surroundings.

A theory of settlements and urban ecology: is it necessary?

- ★ Until now **gradient analysis** has been mainly applied in purely ecological research, but the inclusion of social, economic, and cultural components would produce **a more holistic view as emphasized by the human ecosystem model.**
- ★ The combination of this model and gradient analysis to studies of the special properties of settlements and urban ecosystems (isolation, invasion, and succession) would seem to form a fruitful approach to settlements and urban ecological research.

Thank you

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