

FRONTMATTER:

Abstract

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Acronyms Used in this Work

**An Adaptive Ecosystem Approach
to Rehabilitation and Management of the
Cooum River Environmental System
in Chennai, India**

by

Martin Joseph Bunch

A thesis

presented to the University of Waterloo

in fulfilment of the

thesis requirement for the degree of

Doctor of Philosophy

in

Geography

Waterloo, Ontario, Canada, 2000

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

BUNCH, MARTIN J. AN ADAPTIVE ECOSYSTEM APPROACH TO REHABILITATION AND MANAGEMENT OF THE COOUM RIVER ENVIRONMENTAL SYSTEM IN CHENNAI, INDIA

xviii and 404p., 53 tables, 61 figures and 24 boxes

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This research investigates the application of an adaptive ecosystem approach to the problem of the Cooum River and environs in Chennai (formerly Madras), India. The Cooum River is an extremely polluted urban stream that flows into the Bay of Bengal through the heart of Chennai, India's fourth largest metropolis. During the dry (non-monsoon) season, the upper reaches of the river are dry and flow in the river may be attributed primarily to the production of sewage by the city's population. The river is essentially a foul-smelling open sewer.

Complexity of the problem is due as much to human factors (population growth, poverty, uncontrolled urban development, jurisdictional conflicts, modes of behaviour of the citizenry, and institutional culture) as to physical characteristics of the system (flat topography, tidal action, blockage of the river mouth by sand bar formation, and monsoon flooding). Uncertainty in the situation is both structural (regarding main processes and activities in the system and the nature of relationships among the various actors and elements), and parametric (having to do with scarcity, poor quality and restricted access to data).

This work has drawn upon methods and techniques of Adaptive Environmental Management and Soft Systems Methodology to operate the ecosystem approach and address the problem. Specifically, this has involved a series of workshops which have brought together planners, researchers, NGOs, and other stakeholders in a participatory process oriented toward problem definition, system identification and conceptualization, determination of objectives for management, and the generation and exploration of management interventions. In addition, a central component of the program has been the development of a loosely-coupled GIS, environmental simulation model, and a decision support module. This is based upon a framework provided by participants in the first workshop in the series, and operationalizes a common understanding of the system.

In addition to generating new insight into the nature of the problem situation, the research has provided a potentially useful tool to planners, managers and researchers in Chennai in the form of a GIS database and decision support system (DSS). Aside from the tool itself, it was found that the *process* of developing a conceptual model, and attempting to represent this in the DSS has made a significant contribution to understanding of the Cooum system. In particular, this process forced assumptions to be stated explicitly and publically, highlighted areas of uncertainty and led to new understanding in participants' conception of the problem situation. The program of research also provided a much needed forum for open debate and exchange of information which was removed from the restrictive institutional culture of government departments.

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Acronyms Used in this Work

ADB	Asian Development Bank
AEAM	Adaptive Environmental Assessment and Management
BOD ₅	5-day biochemical oxygen demand
CATWOE	A ‘Root Definition’ mnemonic used in SSM (Customer, Actor, Transformation, Weltanschauung, Owner, Environment)
CMA	Chennai Metropolitan Area
CMDA	Chennai Metropolitan Development Authority
CMWSSB	Chennai Metropolitan Water Supply and Sewerage Board (‘Metrowater’)
DO	Dissolved oxygen
DESERT	<i>DE</i> cision Support system for <i>E</i> valuating River basin <i>s</i> trategies
DSS	Decision Support System
EWS	Economically Weaker Section
FSV	Future Search Visioning
GIS	Geographic Information System
GOI	Government of India
GOTN	Government of Tamil Nadu
GUI	Graphical User Interface
GRASS	Geographic Resources Analysis Support System
HAS	Human Activity System
HIG	Higher Income Group
HUDCO	Housing and Urban Development Corporation of India, Ltd.
INTACH	Indian National Trust and Cultural Heritage
LIG	Lower Income Group
IAS	Indian Administrative Service
ISI	Indian Standards Institute
MIG	Middle Income Group
MMDA	Madras Metropolitan Development Authority (now the CMDA)
MMWSSB	Madras Metropolitan Water Supply and Sewerage Board (now the CMWSSB)
NGO	Non-governmental Organization
ODBC	Object Database Connectivity
OGDI	Open Geospatial Datastore Interface
OLE	Object Linking and Embedding
OOP	Object Oriented Programming
PCB	Pollution Control Board (same as TNPCB)
PNS	Post Normal Science
PWD	Public Works Department (same as TNPWD)
RD	Root Definition
SSM	Soft Systems Methodology
STP	Sewage Treatment Plant
SWD	Storm Water Drainage
Tcl/Tk	Tool Command Language/Tool Kit
TNPCB	Tamil Nadu Pollution Control Board
TNPWD	Tamil Nadu Public Works Department
TNSCB	Tamil Nadu Slum Clearance Board
TNWSDB	Tamil Nadu Water Supply and Drainage Board (same as TWAD)
TWAD	Tamil Nadu Water Supply and Drainage Board (same as TNWSDB)
UNCHS	United Nations Centre for Human Settlements
WAMP	Citizens’ Waterways Monitoring Programme
WRO	Water Resources Organization (of the TNPWD)