

Preface

The increasing growth rate of industrialization, urbanization, and population negatively affects environmental quality and hence plant, animal, and human lives. An environmental management system is designed to facilitate the management of all environmental impacts related to a company's activities for continuous improvement of environmental performance.

Environmental systems are usually stochastic, multiscale, and spatial- and temporal-dependent processes and tend to comprise complex interactions among social, cultural, physical, chemical and biological processes. These processes are difficult to represent, causing considerable uncertainty. Intelligent environmental decision support systems can play a key role in the interaction of humans and ecosystems, as they are tools designed to cope with the multidisciplinary nature and high complexity of environmental problems. Intelligent techniques such as swarm optimization, neural networks, genetic algorithms, etc., are the successful tools for the solution of these complex problems.

This book handles intelligent systems in environmental management in eight main sections; namely, management, disaster response management, energy management, water resources management, sustainability, environmental economics, land-use planning, and transportation.

Chapter 1 gives an introduction to intelligent systems in environmental engineering. It summarizes environmental management fields and intelligent techniques that could be used in environmental management.

Chapter 2 examines hazardous waste management. To support the hazardous waste transportation, it proposes a systematic and integrated multi-criteria decision-making approach based on intuitionistic fuzzy TOPSIS and applies to a real case in Turkey.

Chapters 3 and 4 focus on wastewater management.

Chapter 3 develops two self-adaptive design algorithms for generating the layout and sizing of sewers. It introduces four metaheuristic methods of Genetic Algorithm (GA), Simulated Annealing (SA), Particle Swarm Optimization (PSO), and Tabu Search (TS) for optimum design of the network.

Chapter 4 presents a norm-aware multi-agent system for social simulations in a river basin for integrated wastewater management systems. The presented norms are inspired by European policies for wastewater management and can evolve through time. Moreover, the proposed method is applied to the Besòs River Basin.

Chapter 5 deals with solid waste management. It proposes a fuzzy mathematical model that, along with the cost minimizing, considers a second objective which minimizes the pollution affecting the populated districts. The model also determines the optimal locations of transfer centers and land filling areas while minimizing the total cost and pollution.

Chapter 6 applies fuzzy rules into crisis management using the data gained from the crisis management center in a Polish district. The proposed approach allows the managers to identify events with serious or even disastrous consequences, which would not have been identified otherwise.

Chapter 7 focuses on maritime environment disasters. This chapter proposes an intelligent system which consists of model-base, database, environmental disaster management actions, ship operation management actions, user interface, and environmental disaster modeling and decision support unit.

Chapter 8 analyzed changes in the solar energy generation capacity for different scenarios using fuzzy cognitive maps. The factors that affect solar energy usage and the relations among the factors are revealed based on both a comprehensive literature review and experts' opinions.

Chapter 9 proposes a model to plan efficiently natural gas consumption in a combined cycle gas turbine power plant using evolutionary algorithms. The proposed model takes the costs of natural gas, ignition and maintenance of the turbine into account and analyzes power plant with respect to the effects of market price changes to the amount of natural gas needed for production.

Chapter 10 provides a firefly algorithm-driven simulation-optimization approach for modeling water resources management problems. This approach can be used to efficiently create multiple solution alternatives to the problems containing significant stochastic uncertainties that satisfy required system performance criteria.

Chapter 11 proposes a new fuzzy neural network based model, called evolving fuzzy neural network, that extends existing artificial intelligence methods for modeling hourly dissolved oxygen concentration in river ecosystem.

Chapter 12 demonstrates a new approach for measuring sustainable development levels of the countries using a cumulative belief degrees approach. The approach enables the use of an incomplete data that is one of the critical problems in measuring sustainability of countries.

Chapter 13 describes possible supply chain risk factors in which both physical objects and information are taken into account by considering the whole e-commerce elements. In modeling process, rule-based fuzzy inference system approach is applied by the virtue of the dynamic structure of sustainable supply chain.

Chapter 14 develops engineering economy techniques under fuzziness to be employed in environmental problems. Ordinary fuzzy sets, type-2 fuzzy sets,

intuitionistic fuzzy sets, and hesitant fuzzy sets are handled in the development of fuzzy environmental economy analyses.

Chapter 15 compares underground waste bins and roadside waste bins in a solid waste collection system from economic perspective using type-2 fuzzy net present worth analysis.

Chapter 16 addresses the operational planning of a forest bearing in mind that forest management involves a multiplicity of goods and services. The proposed model, which uses metaheuristic procedures, not only includes economic and sustainable development objectives but also takes into account the key role trees play in counteracting the greenhouse effect.

Chapter 17 presents a novel urban land-use planning methodology via the integration of Analytic Hierarchy Process (AHP) and Fuzzy Rule Based System (FRBS) in order to represent the uncertainty in the system in a certain level to assess urban land-use suitability.

Chapter 18 introduces a fuzzy method to define optimum allocation of the service centers for sustainable transportation networks service using base fuzzy set, antibase fuzzy set, and vitality fuzzy set definitions of fuzzy graph.

Chapter 19 develops a dynamic geoinformation model with temporal dependence of the parameters and a procedural model of routing with temporal dependence to deal with the problems of the sustainable transportation network from geographic information systems for intelligent control.

We hope that this book will provide a useful resource of ideas, techniques, and methods for research on intelligent environmental management. We are grateful to the referees whose valuable and highly appreciated works contributed to select the high quality of chapters published in this book.

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