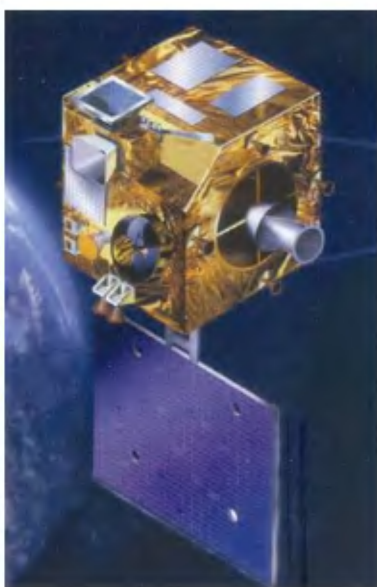


The ability of space scientists to learn from the failures/anomalies of launch vehicles has been described at length in the context of the development of reliable launch vehicles. GSLV and its variants are emerging as vehicles to propel India to complete self-reliance in launching the heavier INSAT satellites into GTO. Midstream, the author adds other developments/facility creation such as radars, high altitude test, computer simulations, etc. The challenge of developing the cryogenic motor to enhance the performance of GSLV has also been described in addition to the initiatives to develop the Scramjet engine. This is followed by a good description of the INSAT (communication satellite) utilization which emerged in 1977, as a joint venture of 4 ministries of the government of India. Applications include weather watch, education, television, broadcasting, search and rescue, direct to home television, tele medicine, village resource centers, etc. which have all been well brought out by the author in this book.

Experiences gained from the SITE experiment and APPLE communication satellite project have paved the way for the INSAT programme. The Apogee Boost motor, earth sensor, momentum wheel, communication transponders, deployable solar panels and tracking systems technologies were all indigenously developed. ISRO has also developed several critical technologies, such as gyroscopes, Earth/sun/star sensors, solar array drives, pressure transducers, control engines, etc.



Kalpana-1: a weather satellite

in this process on INSAT systems. The author has brought in the importance of space debris and how ISRO has already taken initiatives in this regard.

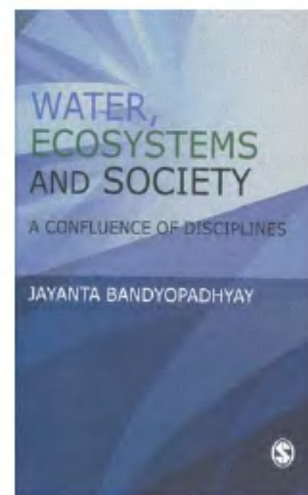
The book covers the history of satellites starting from experimental Aryabhata Satellite in 1975 to Bhaskara and Rohini, to operational systems from March 1988 with IRS 1A, through IRS 1B, 1C, 1D, P3, P4 (OceanSat 1), P5 (CARTOSAT 1), P6 (Resource Sat 1) to Cartosat 2 (launched in 2007). PSLV has become the workhorse from the launch of IRS 1D onwards. Descriptions of the CCD-based imaging sensors developed for the IRS series are also included in the book.

With regard to applications of Remote Sensing, the author has collated a good number of applications in a few pages (section 36). However, the application examples are not organized based on theme/discipline. To the reviewer the description of microwave sensor (SAR) in this section seemed rather inappropriate. The section 37 very briefly covers GIS and Village Resource Centres (VRC). This innovative concept of taking the benefits of space technology to the villages in the form of VRCs has been the brainchild of Madhavan Nair. This aspect the author has missed out. The book concludes with a brief description of Chandrayaan 1, astrosat missions, and Indians in manned space missions.

In summary, this book provides an interesting reading on how India's indigenous space programme evolved to its present state of being on the forefront of technology. It has strong technological perspective but does not provide adequate end use application examples. The author succinctly describes the growth profile, the critical stages, lessons learnt from each success as well as the few failures. Applications of remote sensing have not been covered adequately, and not mentioning the National Natural Resource Management System (NNRMS) is conspicuous. The mention of microwave as well as ocean wave in the same paragraph using the term 'wave' on page 230 is misleading. However, this is a very useful book for general reading and for libraries.

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**Water Ecosystems and Society: A Confluence of Disciplines.** Jayanta Bandyopadhyay. Sage Publications India Pvt Ltd, B1/I-1 Mohan Cooperative Industrial Area, Mathura Road, New Delhi. 2009. xiv + 191 pp. Price: Rs 550.

In the current global scenario, water and sustainable development are intrinsically linked. More so, in a developing country like India, where, without adequate supply and scientific management of water resources, sustained socio-economic development is difficult to achieve. Conventionally management of water resources in the country has been dealt under separate disciplines of engineering, geology, ecological sciences and policy studies. An absence of dialogue between the disciplines has often resulted in situations that have impacted large populations of the society. A case in point is the government initiative to provide aquifer-based drinking water to large sections of rural populace in the country to minimize risks of microbial contamination in drinking water and provide potable water, where surface water sources are inaccessible. Unmitigated extraction of the groundwater sources without due considerations of hydrogeology and geochemistry of the aquifers have exposed large sections of the society to risks of arsenic contamination (Assam, West Bengal, Chhattisgarh, Bihar, Uttar Pradesh) and the more widespread fluoride contamination (notable in states of Andhra Pradesh, Rajasthan, Karnataka, Gujarat, Punjab, Madhya Pradesh, Uttar Pradesh, Bihar, Tamil Nadu, Chhattisgarh) from drinking contaminated groundwater. The time has arrived where efficient management of water resources needs an understanding

of linkages between engineering, sciences, and policies. In line with this thinking, the book by Jayanta Bandyopadhyay on *Water Ecosystems and Society* is a welcome contribution that describes a holistic approach towards management of our water resources.

The book comprises of four well-written chapters. Chapter 1 deals with the interdisciplinary knowledge on water systems, chapter 2 deals with eco-hydrological perspective on floods, chapter 3 deals with valuation of water and its policy implications and the last chapter is on the river-link project.

The first chapter deals with the unique features of India's water systems, the history of formal water management in India, the reasons for disconnect between water systems knowledge and water resource development in India and finally outlines a research agenda for an interdisciplinary framework for water systems management in the country. In the list of research themes provided in this chapter, item 1 focusing on the generation of eco-hydrological knowledge on the surface water systems could also have considered degradation of surface water resources from anthropogenic activities which besides impacting the availability of quality water also affects the ecosystem supported by the fresh waterbodies. Item 7 on emerging water technologies and options in water systems management suggests the use of desalination technology as dramatic solution for providing potable water to habitations located along the coastal belt of India. Caution must however be exercised in wide-scale use of this technology. As an example, if reverse osmosis (RO) technology was used to supply potable water to approximately 1/4th of the population in Chennai (population 4.3 million) it would involve treating 100 million litres of sea-water (approximate dissolved salt concentration = 25,000 mg/l) on a daily basis (assuming a supply of 100 litres per day per

person). Assuming that the dissolved salt concentration of the product water is reduced to 500 mg/l, a 40–50% product water recovery will generate 50–60 million litres of RO reject with an enhanced salt concentration of approximately 50,000 mg/l on a daily basis. Discharge of the saline RO reject into the sea may endanger the marine ecology, while discharge on to the ground would render the groundwater saline. Consequently, use of such technologies must factor costs for preventing ecological and environmental degradation along with capital and energy costs before implementation.

Chapter 2 provides a detailed insight into the eco-hydrology of floods. The chapter examines the causes and conditioning of floods and the ecological and socio-economic dimensions of floods. It highlights the ecological benefits of floods that include transport of fertile silt loads, breeding of fish population, control of salinity ingress, nutrient cycling and groundwater recharge. It also focuses on evolving concepts of living with the floods by making optimal use of services rendered by river inundation and adoption of strategies that can allot space to accommodate river overflows. It has been rightly pointed out that the restoration of waterways and drainage channels are some of the key features to arrest floods. The annual occurrences of floods in some of the urban centres from choking of natural flow-paths due to poorly planned and often illegal human activities are a case in point for the above.

Chapter 3 focuses on the role of economics in water management using the concept of valuation as a tool for the efficient management of water resources. Methods for valuation of water in agriculture, industry and domestic sectors and the economic valuation of ecosystem services provided by water are discussed. The discussion on the scarcity value of water resources aptly brings out the need to focus on scarcity in terms of both

water quality and quantity. As an example of the above, cities, towns and villages along the coastline of India have an excess in terms of water quantity but have scarcity with respect to its quality. Perhaps the verse 'Water, water everywhere, nor any drop to drink' in Samuel Coleridge's, poem *The Rime of the Ancient Mariner* somewhat typifies their sad predicament.

Chapter 4 examines the economic viability, social acceptability and ecological sustainability of the river-link project. It addresses issues pertaining to the role of the proposed ILR (inter-linking of rivers) in controlling floods in high rainfall areas and providing water security to water starved areas of the country, dependency of India's food-security on the proposed river-link and the availability of comprehensive knowledge base for taking up the Himalayan component. The chapter proposes looking at alternatives to improve the country's food and water security rather than investing in the river-link project. The example of China is provided in this context: China has only half the arable land per capita as India, and is attempting to increase its agricultural output by increasing the water use efficiency and not thinking in terms of drastically increasing the volumes of water available for agriculture.

In summary, the book by Bandyopadhyay is an apt text for researchers and practitioners interested in a holistic approach to water management. Books such as these should also find a place in the curriculum in institutions of higher learning so that students get exposure to dimensions of water management other than what they are traditionally exposed to.

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