

3976

AREAS OF RESEARCH AND MANPOWER DEVELOPMENT
FOR COASTAL ZONE MANAGEMENT

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I. Introduction

Coastal zone provides immense opportunities for agriculture, fishery, forestry, tourism and industrial activity. Because economic benefits are derived from coastal zone, the coastal areas team with human settlement. Over 70% of the population live in coastal areas where resources have come to be heavily exploited and the ecosystem is facing problems of pollution, siltation, erosion, etc. To combat these problems, proper management is required. For management, environmental data requirements are very broad and multidisciplinary in nature. Therefore, one needs to develop properly trained human resources.

II. Important Areas of Research

- (i) Living/non-living resources
- (ii) Coastal Processes - Information is necessary because of the impact on marine biota and manmade structures. Knowledge on the nature of sediments can help in understanding pathways and fate of suspended materials.
- (iii) Pollution - domestic, industrial and sewage. Monitoring and control are necessary.
- (iv) Air-sea interaction : undertaking studies on this is vital for planning management. Physical and chemical properties of environment is influenced by topography and climatic conditions.
- (v) Next two decades emphasis will be on engineering due to importance such as sea trade, ports & harbour development, fisheries, recreation and tourism.
- (vi) Sea level rise : global warming due to green house effect (Physical, Chemical, Biological, Geological, Paleoclimatology, etc.). Effect of sea level rise may be catastrophic for coastal areas. Careful planning on regional, national and global are necessary.

- (vii) Islands : Lakshadweep and Andaman islands have exotic fauna & flora. Islands cut off from Mainland possess lot of problem. Conservation of coral ecosystem, fisheries, desalination, local training with reference to tide gauge, pollution monitoring, etc., are important for island development.
- (viii) Underwater exploration : not only for mining and defence but also to tackle various problems such as platform construction, underwater pipe laying and archaeological survey. It is estimated that 40 - 50, trained manpower are needed for exploration, documentation, retrieval and conservation techniques.

III. Environmental Management

Environmental management itself is very broad requires input from different disciplines. Coastal zone management can be conceived as an Hybrid between Regional Analysis & Environmental Management. It also involves analysis of marine education and training requirements for potential and actual uses. Therefore, any regional plan should be based on uses along with assessment impacts, supporting technologies and development.

- (i) Uses increase due to population pressure. Improved technologies lead to easy access to coastal zone - recreation/tourism.
 - (a) Mineral materials, energy exploration and exploitation - oil and gas; placer deposits; chemical elements; carbonate for cement; waves, tides, ocean thermal energy conversion (OTEC); marine polymers and water (desalination).
 - (b) Sustainable capture of biological resources from the coastal zone (flora and fauna). Fisheries - capture/culture - processing, marketing, etc. Reliable forecast on the yields and protection from over-exploitation are important.
 - (c) Aquaculture will be an area of immense growth in most areas of the world and has an impact on coastal zone. Includes - genetic improvement, water quality analysis, disease control, etc.
 - (d) Biotechnology : This field has scope for development of vaccines, genetic engineering, pharmaceuticals, agricultural products, biodegradation, and new methods of ecological monitoring and research.

(e) Engineering works - offshore structures; harbour & ports; transport (surface, subsurface, seabed) and artificial reefs and breakwaters, etc.

(f) Increased human access to and use of coastal zone ecosystems for - tourism and recreation. Specialised environment - mangroves, seagrass and coral reefs. Forestry needs to be given importance.

(ii) Assessment - Make assessment which are internationally comparable using standardised methodologies.

Following types of assessments are pertinent :

(a) Living/non-living resources

(b) Biotechnological implications (release of genetically engineered organisms)

(c) Socio-economic aspects

(d) Cultural and legal aspects

(e) National and international obligations

Special attention to be paid to customary and traditional uses/practices.

(iii) Supporting Technologies : need improved attention and standardised methodologies.

(a) Weather and ocean conditions forecasting

Ocean currents, tides and eddies (pollution dispersal, and island communities)

Catastrophic events - storms and cyclones

(b) Survey data availability and analysis

Remote sensing techniques

Data acquisition and management

Instrumentation and platforms

(ships, aircrafts, submersibles, satellites)

Monitoring equipment for siltation, erosion, pollutants

Communication, navigation and position-fixing instrumentation

Seabed sampling instrumentation for very deep waters

(c) Human health matters

Marine infection, toxicology and allergies

Nutritional value of sea food organisms/alternate sea food

Diving technology/medicine

Detection and removal of toxic chemicals

(d) Materials science - new materials, fouling, biodeterioration, corrosion, etc.

(iv) Coastal Regional Planning

Embraces activity related uses, assessments and supporting technologies.

Poses new challenge - scientific input required and benefits areas from regional planning are :

Recreation, habitation; reclamation of land/sea; port & harbour development; pollution monitoring; management systems; living & non-living resources and Law of the Sea.

IV. Education and Training Requirement

Potential uses are so diverse and management of coastal zone is complex. Management, training and education for understanding, protection and wise use of coastal zone can't depend on science alone. Need to develop science based educational programmes to cater to people or society from generalists to specialists.

(a) Educational needs : Education in marine science based topics is required by general public, decision-makers, politicians, teachers and engineers.

(b) Specialised training courses needed for existing research and teaching staff on mathematical modelling; international network services; management strategies and marine resources/planning.

V. Planning
Problems in Management

- (i) Interaction among use of coast by two or more users physically conflict due to limited space.
- (ii) Destruction of deleterious modifications of valuable environment. Low energy environments - wetlands, marshes, coastal peak and mangroves. These are valuable as breeding/nursery grounds for shrimps/fishes. Pressure to develop these areas for commercial/residential purposes.
- (iii) Pollution of coastal/estuarine region may result in health hazards to humans, their amenities and fisheries.
- (iv) Curriculum is not made to meet the demands of user agencies.
- (v) Problems in coastal zone are due to lack of a well defined government policy towards land use, allocation of resource utilisation; lack of public awareness, political considerations regarding coastal developmental activities and above all financial constraints.

VI. Training Strategy

Training strategy for coastal zone management must be based on the fact that with fast developing technology, there will be corresponding changes in the requirement of skills. Refresher courses, centralised information systems, analytical techniques, mass media communication and training for managers & politicians are important.

VII. Conclusion

The potential uses of coastal zone are diverse. Our demands will continue to increase for settlements, for food, for industrial developments and for recreation in an undisturbed environment. We will naturally look upto the coastal zone to meet all these needs. Our education must forsee areas of concern beyond 2000. Opportunities should be provided to teachers to ensure (for future generations) better basic understanding and multidisciplinary orientation towards coastal environment. We need trained personnel at all levels - technicians, technologists, researchers, planners and managers, for all of which facilities have to be created on a continuing basis. Training of manpower needed by different organizations engaged in exploration and exploitation of coastal zone should be well conceived with the future in mind. This is all the more important in view of the additional responsibilities that coastal nations are assuring under the new ocean regimes.

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