

# **DYNAMICS OF LAND DEGRADATION : A SYSTEMS DYNAMICS APPROACH**

By

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*Submitted in fulfilment of  
the requirements for the degree of*

**DOCTOR OF PHILOSOPHY**



to the  
**INDIAN INSTITUTE OF TECHNOLOGY, DELHI**  
July , 1995

**Dedicated to  
Mrs. Kanta Gadhok (mother)  
and  
Rohit Puri**

## CERTIFICATE

The thesis entitled " **Dynamics of Land Degradation : A Systems Dynamics Approach**" being submitted by Mrs. Charu Puri to the Indian Institute of Technology, Delhi for the award of the degree of **Doctor of Philosophy**, is a record of bonafide research work carried out by her. She has worked under our guidance and supervision, and has fulfilled the requirements for the submission of the thesis which has attained the standard required for a Ph.D degree of the Institute. The results presented in this thesis have not been submitted else where for the award of any degree or diploma.



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## ACKNOWLEDGEMENTS

My greatest thanks go to Prof. P.S. Satsangi, who gave me the guidance and support at the initial stages of this research work. Long discussions with Prof. Satsangi have been very helpful and instrumental in accomplishing this task.

I am sincerely grateful to my supervisor Prof. Madan for being a constant source of support and encouragement and to Prof. Dhar who amongst his manifold engagements agreed to supervise this work and found time to monitor its progress. Both Prof. Madan and Prof. Dhar made valuable and constructive suggestions from time to time and helped me generously in many ways.

I am obliged and thankful to Mr. A.N. Chaturvedi (TERI), with whom I had discussions on the forestry aspects of this thesis. His observations and advise were very useful to me while formulating the 'forestry sub-system' of the model.

I am sincerely grateful to Dr. R.C. Maheshwari (ICAR), with whom I had a chance to interact on the various dimensions of the agriculture sector.

I am thankful to Dr. Jagpal who helped in getting data for this research work and to Dr. Santosh Satya with whom I had lively discussions on the key subject of the thesis - organic farming.

I am thankful to a number of my friends - Anjana Gupta, Dilip Jain, Arvinder Singh, Arun Wadhwa and Anurag Chaturvedi for their frequent help and encouragement.

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## ABSTRACT

As in many developing countries, population growth has placed increasing pressure on land and water resources in India. The increasing demand for forest, agricultural products and grazing has resulted in the overuse of existing land and consequently its degradation. The enormity of the situation is indicated by the fact that out of 266 million hectares of productive land, about 175 million hectares (66 per cent) is degraded to a greater or lesser degree. The annual degradation rate is estimated at around 3.7 million hectares of cropped land.

Besides population build-up, devaluation and discarding of traditional land management practices and agricultural skills and in particular, adoption of intensive agriculture has been responsible for land loosing its fertility.

A detailed literature review has been carried out in this thesis to identify the major factors that degrade land so that suitable steps could be taken to ameliorate the situation.

The system dynamics methodology has been adopted to capture quantitatively the dynamic influence of various factors on land degradation. The system structure has been developed using various tools of the SD - causal loops, flow diagrams and Dynamo equations. The focus of the study has been on understanding macro-level land degradation related problems which are generated by the interactions of the four sub-systems of the model viz. population, livestock,

agriculture and forestry. Some of the important system levels are population, livestock population, net agricultural land, forest land, land degraded (collectively and individually due to various factors), nutrient status in soil etc.

The model developed, incorporates the various causal linkages between land degradation and the factors causing land degradation such as deforestation, intensive agriculture etc. and translates these into mathematical relations. The model has been validated against the data for the State of Punjab for the period 1965 to 1990. Various alternative policies which could mitigate the situation have been formulated and their efficacy has been judged on the basis of their predicted ability to control land degradation without compromising on agricultural production.

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