

Luis Alfonso Sandia Rondón

*Dissertation to obtain
Degree Dr. rer. nat.*

***Sustainable Environmental Planning in
Venezuelan rural areas, Concept and Methodology.
Cases of study: Rivas Dávila Municipality (Mérida State)
and Quíbor Valley (Lara State), Venezuela.***

Chairperson of the Examination Board:
Univ. Prof. Dr. Brigitta Schütt

Supervisors:
Univ. Prof. Dr. Brigitta Schütt - Freie Universität Berlin
Univ. Prof. Dr. Karl Tilman Rost - Freie Universität Berlin



Rivas Dávila Municipality



Quíbor Valley

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Dedication

To my loved wife Luz, and my sons Luis Manuel and Juan Luis,
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Abstract

Sustainable development constitutes one of the most important challenges of current worldwide society. Thus, the development of technical instruments aimed at maintaining natural resources, improving quality of life and guaranteeing the environmental quality for future generations are greatly needed.

Among the instruments for environmental management towards the sustainable development the preponderance of land-use planning and environmental planning processes are recognized. Environmental planning can be understood as political, technical and administrative processes to assess the environmental potentiality and restrictions in order to select and implement the best options of sustainable land-use in accordance with the physical, ecological and socio-economical characteristics.

Environmental planning processes can be applied on different ambits and scales, such as national, regional and local level. In Venezuela instruments of rural environmental planning are needed, in order to control and prevent the environmental impacts, damages and natural hazards. This is not only due to the significant surface of the rural areas, but also because of the wealth of its ecological patrimony.

This dissertation is addressed at formulating a concept and a general methodology of sustainable environmental planning of rural areas. A spatial analysis model was developed as fundamental part of the proposed general methodology. This model, used as an instrument for the physical, ecological and socioeconomic diagnosis required by the environmental planning, allows the integral evaluation of rural territories on a local scale.

The developed “Sustainable Environmental Planning of Rural Areas, SEPRA” model was applied and validated in two rural areas located in the west of Venezuela: Rivas Dávila Municipality, Mérida state; and Quíbor Valley, Lara state.

The spatial analysis model is based on a comprehensive and holistic conception of the environment, in which dynamic interactions between factors and processes determine the environmental stability or instability. This subsequently allows the landscape sensitivity to be evaluated. Taking into account the landscape sensitivity it is possible to determine environmental potentialities and restrictions and, at the same time, it is possible to formulate guidelines for sustainable land-use.

The SEPRA model, which was developed by means of the ESRI ArcGis 9.1 software, required the establishment of analysis criteria as a reference to evaluate the interactions between environmental factors and processes. A successive process of decision making allowed the elaboration of cartographic layers about the analyzed environmental variables, which were successively combined in order to generate integrated synthesis of the environmental stability-instability and landscape sensitivity. In the first evaluation phase the following maps were constructed: Geostructural stability-instability, Hydro-geomorphological stability-instability, Erosion susceptibility, Fragility of vegetation units and Intensity of the land-uses.

Afterwards, the successive integrated analysis of these first results generated a second level of maps, i.e., Physiographic restrictions, Landscape sensitivity and Landscape suitability. This last map, which evaluates the suitability of the land-uses with respect to the landscape sensitivity, constitutes the basis for the guidelines of land-use zonation.

Finally, in both study areas, guidelines for land-use planning were formulated. These guidelines must be considered as a basic reference for a final land-use plan which must be the product of a process of discussion and consensus among all social actors of the researched areas. This allows agreements and compromises for the implementation and fulfillment of the plan.

Zusammenfassung

Die nachhaltige Entwicklung ist weltweit eine der größten Herausforderungen an die heutige Gesellschaft. Dies erfordert die Entwicklung technischer Instrumente, die der Erhaltung der natürlichen Ressourcen, der Verbesserung der Lebensqualität und dem Erhalt der Umweltqualität für zukünftige Generationen dient.

Im Rahmen eines "Umweltmanagements" spielen Landnutzungs- und Umweltplanung eine besonders wichtige Rolle. Umweltplanung kann als ein politischer, technischer und administrativer Prozess verstanden werden, dass die Erfassung Umweltpotentials und die Wahl und Ausführung der besten Optionen einer nachhaltigen Landnutzungsplanung unter Berücksichtigung von physischen, ökologischen und sozioökonomischen Kennwerten zum Ziel hat.

Umweltplanungsprozesse können auf unterschiedlichen Ebenen und Skalen (national, regional und lokal) angewandt werden. In Venezuela wird auf lokaler Ebene vor allem das Instrument der ländlichen Umweltplanung benötigt. Dies gilt nicht nur, weil der ländliche Raum eine besonders große Bedeutung hat, sondern auch, um den Erhalt des ökologischen Erbes zu sichern.

In dieser Arbeit wird ein Konzept formuliert und eine allgemeine Methodologie für eine nachhaltige Umweltplanung im ländlichen Raum entwickelt. Als Teil der Methode wird ein räumlich analytisches Modell entwickelt. Dieses Modell als Instrument einer physischen, ökologischen und sozioökonomischen Diagnose für die Umweltplanung erlaubt die integrierte Bewertung ländlicher Gebiete im lokalen Maßstab.

Das im Rahmen dieser Untersuchung entwickelte Modell "Sustainable Environmental Planning of Rural Areas, SEpra" ist in zwei ländlichen Gebieten in West-Venezuela, Rivas Dávila Municipality im Staat Mérida und Quíbor Valley im Staat angewandt und validiert worden.

Dieses räumliche Modell basiert auf einem umfassenden und holistischen Konzept der Umwelt mit dynamischen Interaktionen von Faktoren und Prozessen, die Stabilität-Instabilität der Umwelt erfassen. Dadurch kann schrittweise die Sensitivität der Landschaft erfasst werden. Dies ermöglicht, das Umweltpotential und Restriktionen zu erfassen, auf deren Basis Richtlinien für eine nachhaltige Landnutzung abgeleitet werden können.

Das SEPRA Modell, das mit Hilfe der Software ESRI ArcGis 9.1 entwickelt wurde, erfordert die Einführung analytischer Kriterien, um die Interaktionen zwischen Umweltfaktoren und – Prozessen zu bewerten. Im Rahmen eines sukzessiven Entscheidungsprozesses werden kartographische Layer der untersuchten Umweltvariablen erarbeitet, die schrittweise kombiniert werden, um eine integrative Synthese der Umweltstabilität-Umweltinstabilität und Sensitivität der Landschaft zu generieren. Im ersten Schritt wurden folgende Karten erarbeitet: Geostrukturelle Stabilität-Instabilität, Hydro-geomorphologische Stabilität-Instabilität, Erosionsanfälligkeit, Fragilität der Vegetationseinheiten und Intensität der Landnutzung.

Im nächsten Schritt werden durch sukzessive integrative Analyse dieser ersten Ergebnisse eine zweite Ebene von Karten generiert: Physiographische Beschränkungen, Landschaftssensitivität und Tragfähigkeit der Landschaft. Diese Karte, die Belastbarkeit der Landschaft auf Basis der Sensitivität bewertet, ist schließlich die Basis für die Richtlinien zur Festlegung von Landnutzungszonen.

Im letzten Schritt werden für beide Testgebiete spezielle Richtlinien für die Landnutzungsplanung formuliert. Diese können als Grundlage für den endgültigen Landnutzungsplan dienen, der auf Diskussionen und Vereinbarungen unter den Beteiligten des untersuchten Gebiets beruhen. Darauf können Vereinbarungen und Regelungen für die Planausführung aufbauen.