INTERMODULAR DESCRIPTION SHEET:	UMAP Unit 775
TITLE:	The Resilience of Grassland Ecosystems

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MATHEMATICAL FIELD:	Differential equations
APPLICATION FIELD:	Biology, ecology
TARGET AUDIENCE:	Students in a course in differential equations

ABSTRACT: This Module introduces students to the *state-and-transition theory* explaining the succession of plant species on grassland and to the concept of *successional thresholds* partitioning plant states into those gravitating toward socially desirable or socially undesirable plant compositions over time. Students are shown how the state-and-transition theory is formulated in the mathematical ecology literature as a system of two autonomous differential equations, and how a successional threshold is defined by the stable manifold to an interior saddle-point equilibrium. A series of exercises directs students toward a qualitative phase-plane solution of the system and an analytical approximation of the stable manifold. Students also gain experience working with the numerical phase-plane plotter Dynasys, which can be downloaded from the World Wide Web. A discussion section applies the approximated stable manifold to the real-world problem of controlling livestock numbers on public grazing land to reestablish more socially desirable plant varieties. The Module is within the capabilities of students having had basic calculus and an introductory course in ordinary differential equations covering phase-plane solutions.

PREREQUISITES:	Introduction to ordinary differential equations covering phase-plane solutions.