Applications of Population Viability Analyses

Population viability analysis (PVA) is used to construct probability models that predict whether a population will persist or be extirpated. From such statistical models, decisions are made about endangered species designation, population management, and habitat conservation. PVA software packages (VORTEX, ALEX, RAMAS) allow the projection of future population size based on “what if” simulations that manipulate various population parameters and predict population size. These simulations provide information to construct management programs and design nature reserves to conserve the population, species, or habitat under study and to construct testable hypotheses for further research. Population viability analysis should continue even after the development of a management plan, and the management plan should be adjusted as indicated by the new information obtained.

Types of models generated from population viability analyses include time series models, which project future population size; autoregressive models, which explore ecological interactions; structured population models, which identify a quantifiable measure of population growth from vital rates calculated for the population; sensitivity analyses, which correlate population growth with changes in a particular population parameter, such as juvenile mortality; and habitat-based models, which employ geographic information systems (GIS) to correlate habitat features with distribution and size of populations within a species and assess the effects of habitat loss and habitat fragmentation.

Caution must be exercised in the interpretation of models generated from population viability analyses. The current conditions for a local population might not hold for all populations of the species; therefore, conclusions for the species as a whole might not be valid. The current situation might change to increase or decrease local population size. Variation in the environment, in demography, and among individuals themselves leads to uncertainty in the models. Therefore, a model should be used as a guide for management decisions and adjusted as needed.

Another use of population viability analysis is in epidemiology, which is the study of disease transmission between populations. For example, when cultivated rice was attacked by grassy stunt virus in the early 1900s, PVAs were conducted on over 700 populations of wild-growing rice. A population resistant to the virus was discovered, and careful cross-cultivation successfully transferred the genes for resistance from the wild population to the cultivated population, thereby saving a species that is a major food staple for much of the human world.

A similar situation currently exists for the Tasmanian devil, an Australian marsupial. Scientists believed the species would become extinct within 20 years because of maxillofacial tumor disease (MFTD), a communicable cancer transferred from one devil to another during communal feeding. The cancerous tumors erode the chewing muscles of the devils, causing them to starve to death. PVAs located a population resistant to the cancer in a remote part of Tasmania. Individuals from this

population are being introduced into populations all over the island in the hope that the genes conferring resistance will be passed on to all populations, thus eradicating the disease and saving the species from extinction.