# Control Model

NCA-Savanna Control Model

Total biomass, by plant groups

As you have already likely noticed, the control model includes seven types of vegetation (palatable grass, palatable forbs, unpalatable herbs, palatable shrubs, unpalatable shrubs, evergreen trees, and deciduous woods).



Leave biomass for herbaceous plants

The changes in plants are modeled for a 15 year period, from 1973 to 1988. Note that Savanna knows only the weather patterns from that time period - the system is meant to model Ngorongoro as it is now.

Herbaceous green and dead biomass, for a typical April to July
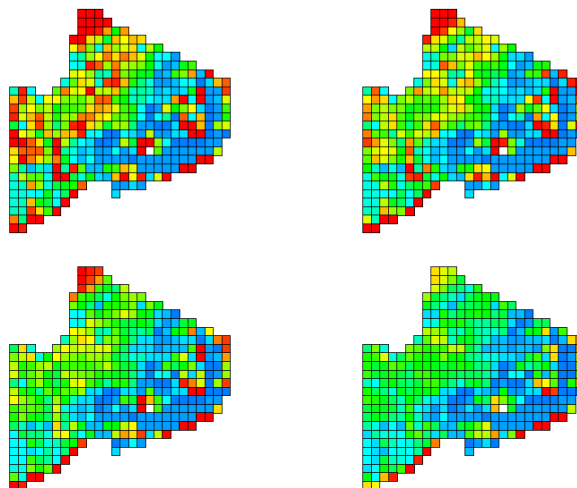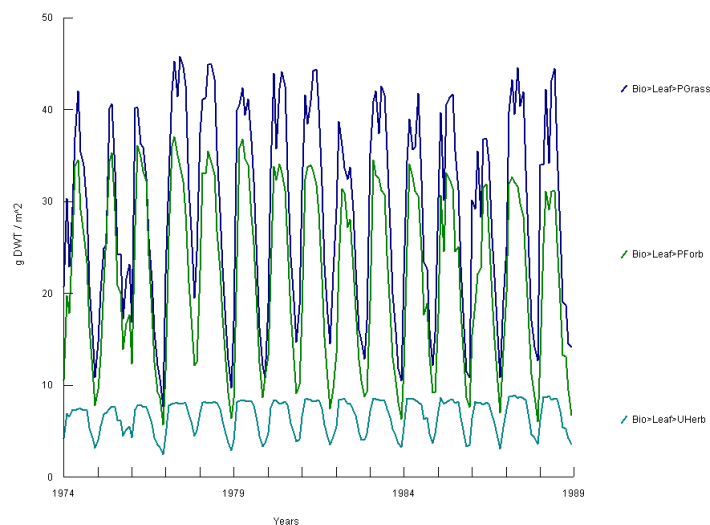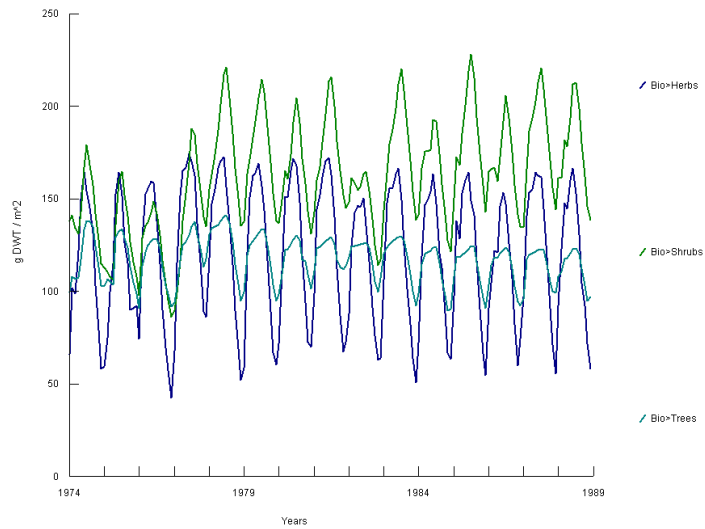
Root biomass for herbaceous plants

Changes in total biomass may be seen within years, in response to the wet and dry seasons.   In addition, particularly dry periods, like the late 1970s yield less biomass than wetter periods, like the early 1980s.
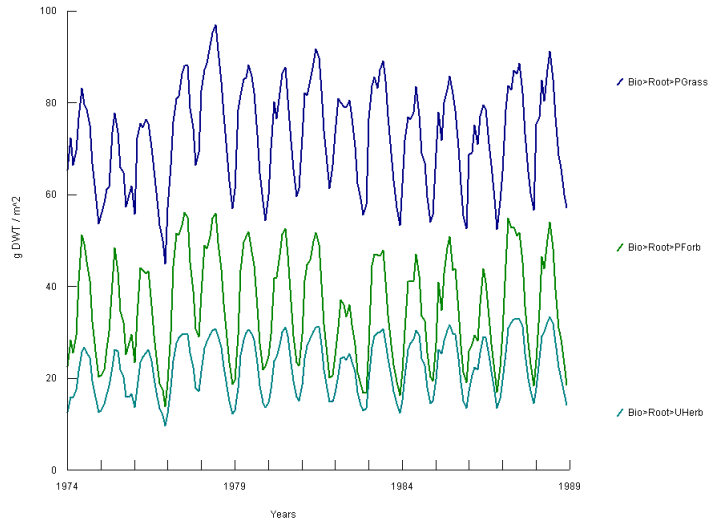
Maps show total green biomass high in the Northern Forest Highlands Reserve, but the amount of herbaceous biomass lower. Areas distant from water can build-up high biomass, because animals cannot graze readily in those area.
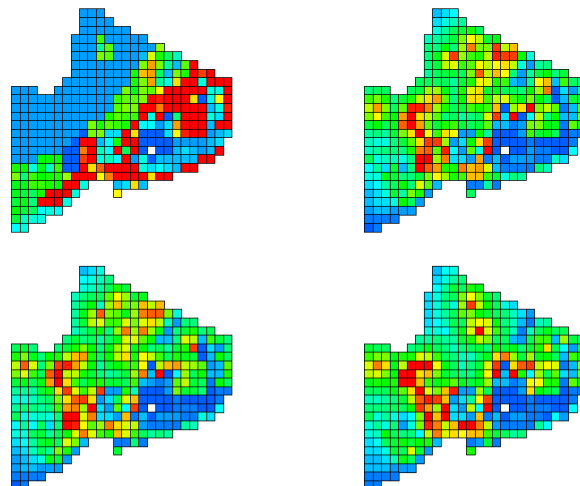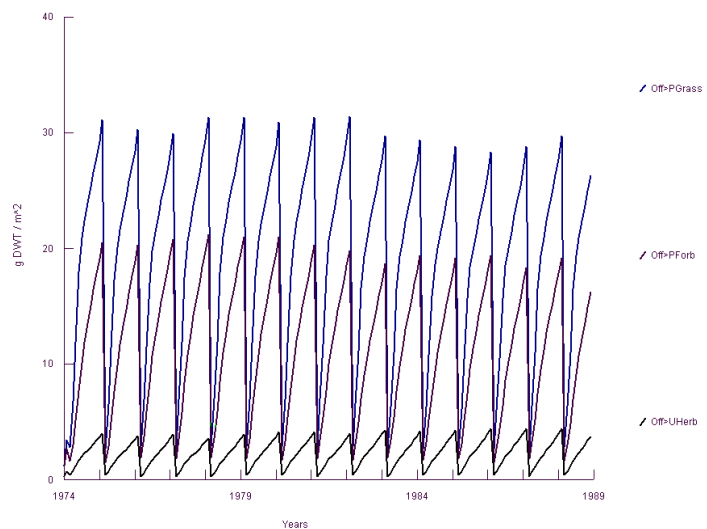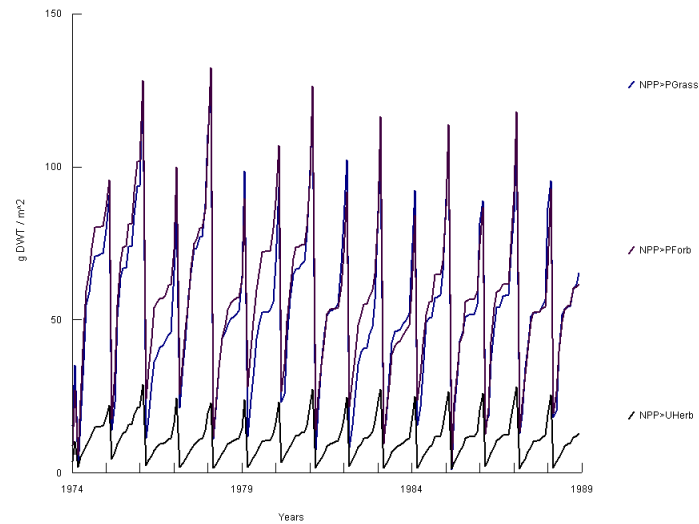
NCA-Savanna Control Model (continued)

Annual Net Primary Production for herbaceous plants

Several of the variables produced by Savanna are cummulative, meaning that they are summed throughout the year, then reset to zero on January 1. This is true for the ANPP and offtake charts shown.

Offtake of herbaceous plants by animals

Areas for Maasai herders to graze cattle in the wet season are limited, as shown in the first map, for April. May and June are transitional months, and July is in the dry season, with animals clustered around water.

The distribution of cattle for a typical April to July

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Livestock populations

Like the vegetation charts, the chart of livestock populations shows changes over each year, as animals die and are born, and over the long term, as dry and wet periods pass. These populations are also controlled by the amount of disease infecting the animals. In wet months or years, more animals die from disease than in dry months or years, for example.
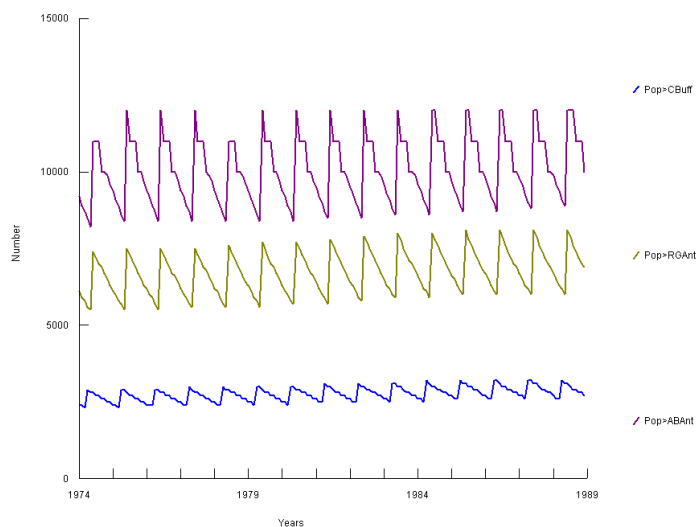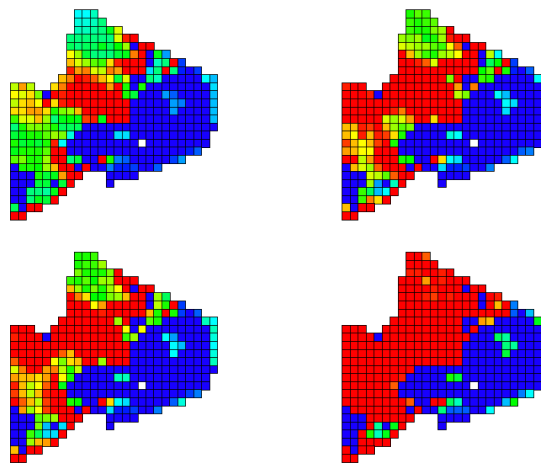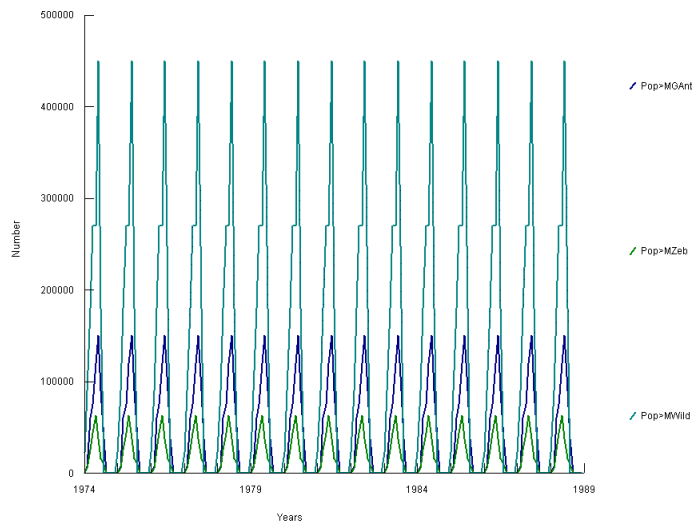
NCA-Savanna Control Model (continued)

Migratory populations within Ngorongoro Conservation Area (wildebeest, zebra, and grazing antelope)

Populations for migratory animals are set as constant in NCA-Savanna. The proportion of animals on NCA changes from month to month, but the total does not.
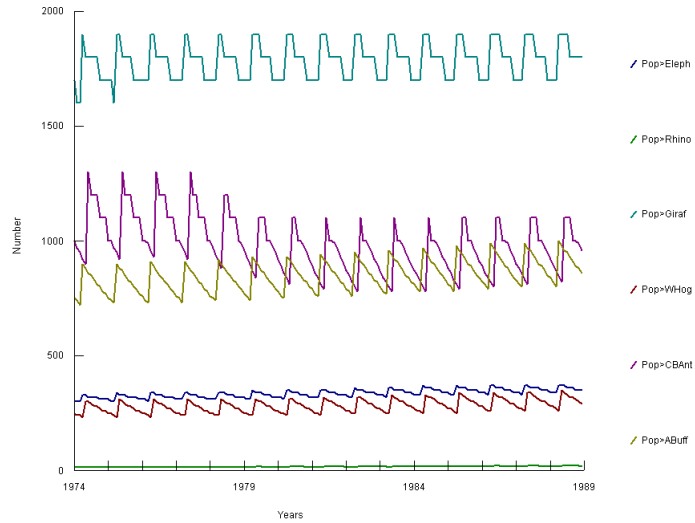
The distribution of wildebeest, a typical January to April

An ongoing application of Savanna will model the entire ecosystem, and include population changes for migrants.

Populations of moderately common animals (crater buffalo, resident grazing antelope, and area browsing antelope)

There is a mix in the distribution of rarer animals in NCA-Savanna, with rhino and crater browsing antelope restricted to Ngorongoro Crater, elephant and warthog occurring in and outside the crater, and area buffalo and giraffes entirely outside the crater. Of course, the distinction between crater buffalo and area buffalo is somewhat artificial, used to here have better control over subpopulations.