

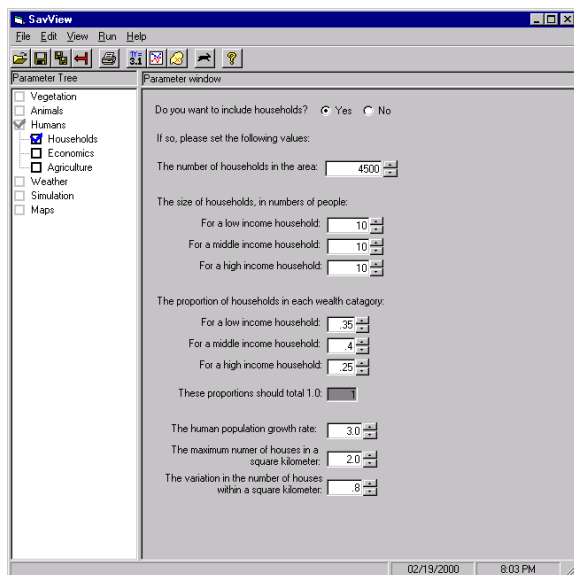
Experiments - Households and Agriculture

Ngorongoro Conservation Area was created as a multi-use site, with management to balance the needs of humans and wildlife. The last estimate by the Ngorongoro Conservation Area Authority is that there are 51,621 residences of NCA, and that their population is growing at about 3% per year.

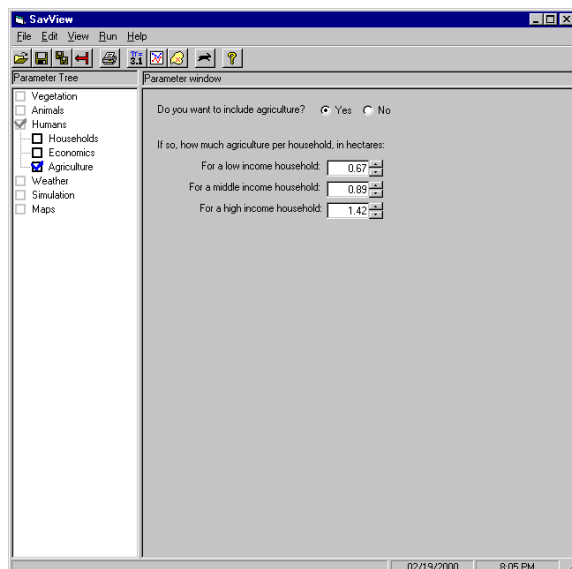
In 1975 agriculture was outlawed in NCA, the was reinstated in 1992 on a temporary basis, and extended indefinitely in 1998. The effects of agriculture upon the Ngorongoro ecosystem is a contentious issue. Some consider cultivation within a conservation area inappropriate, whereas others cite the need to support the pastoralists encouraged to have a more sedentary life-style by policy changes.

Savanna can be used to outline potential changes in the Ngorongoro ecosystem if agriculture is allowed to expand. Whether the predictions are precise or not, the model creates a common set of responses that people can frame discussions around.

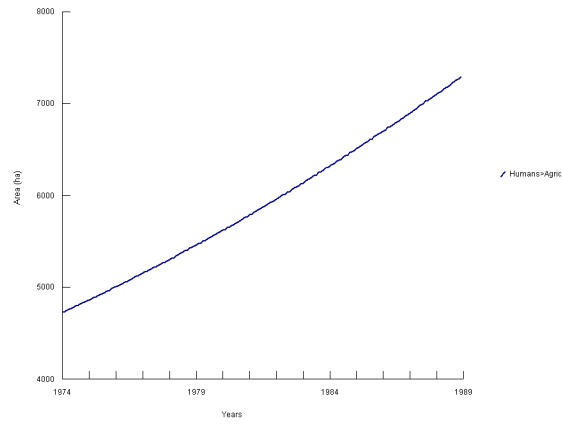
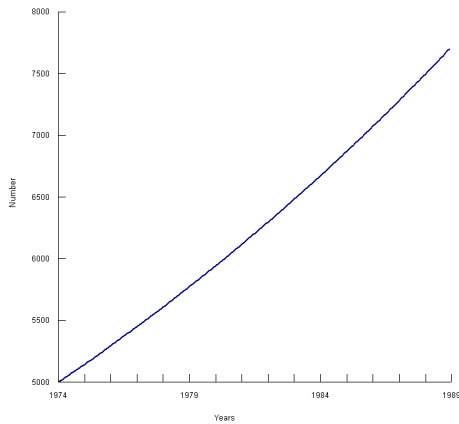
Enabled household modeling



Enabled agricultural modeling

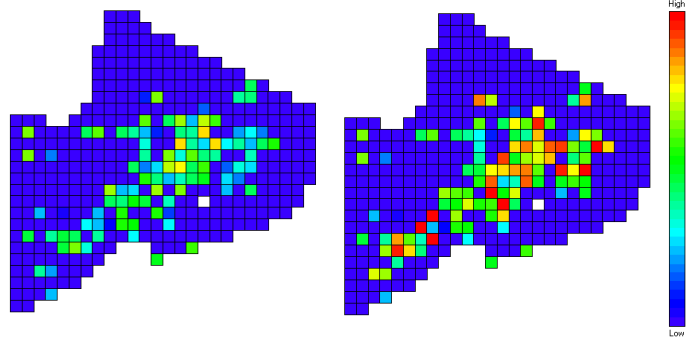


Experiments - Households and Agriculture (continued)



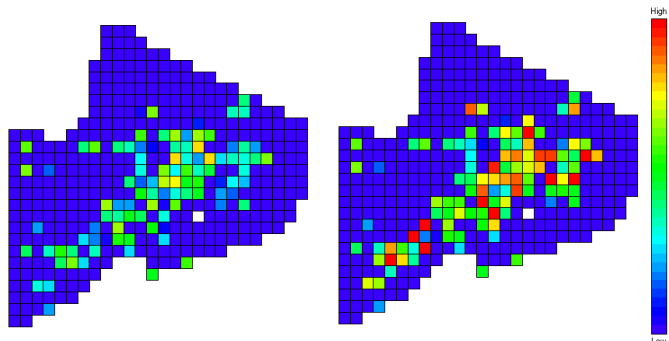
The growth in households (left) and agriculture (right) when human population growth is at 3% annually.

Households at the beginning (left) and end (right) of the simulation.



Households and agriculture are placed in the Savanna model based upon their distribution in a 1991 aerial survey of households. In general, the midlands and highlands of Ngorongoro Conservation Area are occupied in the model. In the 15 years at 3% growth, agriculture goes from about 4,750 ha to 7,300 ha.

Agriculture at the beginning (left) and end (right) of the simulation. Note that the red, densest cells have 4 hectares in crops 200 in each square kilometer.



Experiments - Households and Agriculture (continued)

We've seen that the changes in the Ngorongoro ecosystem when agriculture was put in place were relatively small. This might be predicted given that less than 1% of the site was being cultivated at the end of the 15 year simulation.

As an experiment, we may ask what the response of animals might be to agriculture at various levels, such as from 0.5% up to 5%. We will set each household to have 5 ha of agriculture, which is above the average, but not by a great deal, and add households through a series of 10 simulations. The simulations will have human population growth rate set to zero (not changing) and, given that the NCA and its 5 km buffer are about 10,000 km², the number of households will be:

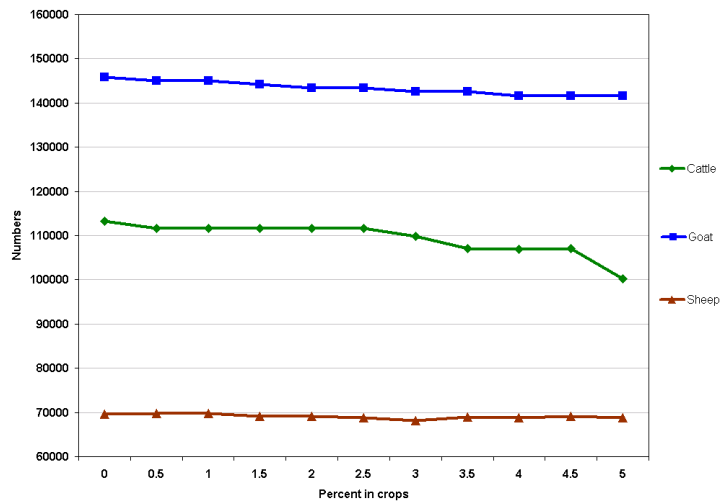
Households	Cropping (ha)	Agriculture (%)
1,000	5,000	0.5
2,000	10,000	1.0
3,000	15,000	1.5
4,000	20,000	2.0
5,000	25,000	2.5
6,000	30,000	3.0
7,000	35,000	3.5
8,000	40,000	4.0
9,000	45,000	4.5
10,000	50,000	5.0

Wildlife and livestock populations will start-out at the same level for each of these model runs, but will likely end the 15 year simulation at different levels. We need to select a point in time to compare the

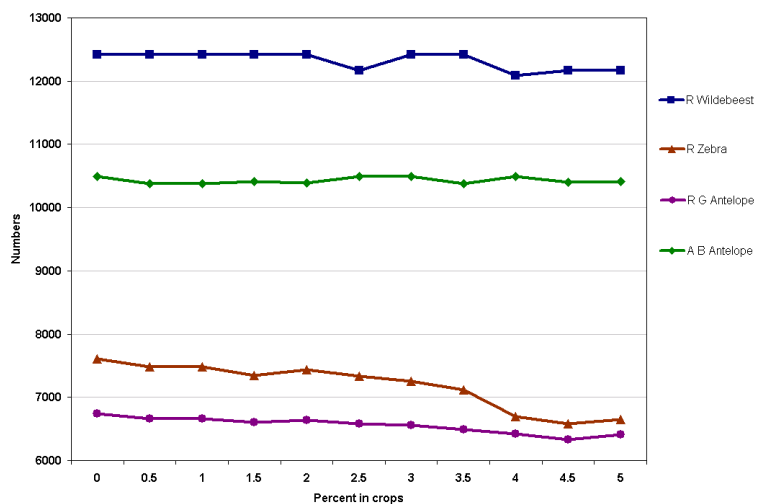


Experiments - Households and Agriculture (continued)

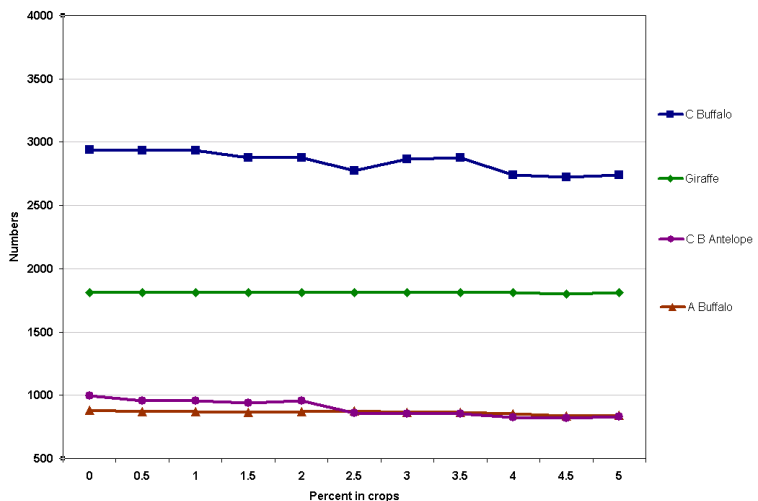
Average populations of livestock in the final year of simulation, for 0.5% to 5% agriculture



Average populations of common wildlife in the final year of simulation, for 0.5% to 5% agriculture



Average populations of uncommon wildlife in the final year of simulation, for 0.5% to 5% agriculture



Presenting Savanna Results

We've seen that Mike Coughenour's Savanna produces an impressive array of output. In general, however, that output requires formatting and explanation to be useful in making policy decisions. When an individual or small group is using Savanna to address management question, the outputs from SMS and SavView are typically adequate to illustrate model responses. When presenting results to larger groups, further interpretation is often needed. Equally importantly, those using Savanna results in discussions should be aware of the nature of the model, at least in the generalist of ways.

Technical Matters

There are several means to place Savanna output into a form appropriate for large audiences or reports:

- An easy way to modify SavView output is to make screen captures of the program, and change or combine output in what is called a Paint program. Using such a program, you may make whatever changes or additions to the output that you wish, including making a dark background for a slide, adding a large title, or explaining some portion of the image. The methods to do this are included in the exercise that follows.
- We regularly will import the tabular data from Savanna into spreadsheet programs, such as Microsoft Excel. The bulk of output from Savanna is in what is called 'comma delimited' ASCII format, meaning that the files are in a simple text format, with commas separating each of the columns of output. In general the format of the files is straightforward, although some do require



Presenting Savanna Results (continued)

Technical Matters (continued)

- The maps used in SavView to show inputs into Savanna are simple images, stored within the \SavView\Bitmaps directory. They may be used directly to make slides or for reports, if you wish.
- Sometimes we combine the results of several simulations. The example we have seen is running 10 simulations, with different levels of agriculture, but using only the ending population levels. In general, output from each analysis can be imported into a spreadsheet program, and the values of interest saved in another document.
- Savanna produces maps in its own, compact format. They cannot be used directly in geographic information systems (GISs). However, both SMS and SavView can export these maps into formats that can be used by IDRISI, ArcView, or ARC/INFO. To reach these utilities in SavView, go to “File” and select “Export results...” A window will appear with more information.
- Lastly, the printing tools in SavView are being developed, but the graphics SavView produces may be sufficient to illustrate your points.

Presenting Savanna Results

Many of those you show Savanna products to will be unfamiliar with ecosystem modeling, spanning from not understanding some particular trait of the model, to not understanding why a year’s worth of ecosystem changes may be estimated in anything under a year. We must ensure that there is some minimal understanding of the results that we show. Using care when preparing and presenting materials can help avoid confusing those entirely unfamiliar with modeling.



Presenting Savanna Results (continued)

- Some people have great knowledge about a particular aspect of the ecosystem, such as a small patch of land. If the model does not predict what might happen in that patch of land, they may discount the entire set of results. A common example is from vegetation mapping. If a particular grid cell in the Savanna map does not show what the person knows to be present at that cell, they may discount the map entirely, and perhaps even the potential uses of Savanna. Another example might be a small change in an animal population that is not shown in Savanna.

Encourage those using Savanna results to consider those results as a whole, over the entire Ngorongoro Conservation Area, as the model was parameterized. The question they should ask should not be “Do the results exactly match what I have seen at my favorite camp site?” but rather: “Do the general trends represented seem reasonable?”; “Are there unexpected results shown, but in hind-site are reasonable?”; and “Would these results form a starting point for discussions between stakeholders?”

- People viewing results should keep in mind that producing a valuable Savanna model for a site is an iterative process. As the model improves with each version, the predictions it makes provides a framework for evaluating the consequences of management decisions. As those decisions are adopted or abandoned, and the predictions of Savanna evaluated, the feedback may be used to improve the model.

In general, however, the feedback regarding Savanna and its Ngorongoro application has been positive. Some of the most common comments received have been on ways to make the model more inclusive, and applicable to more problems.



