



## **SAVANNA for Windows 94.10a**

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Translated by Hitoshi Ozawa

SAVANNA for Windows 94.10a was originally written for educational use. It simulates and graphs the fluctuation of organisms in the food chain. To actually observe and record this relationship, unfortunately, requires time, effort, and money. Thus, in most cases, only some sample data are listed in the text book. These data may be sufficient to show that there is some relationship between organisms, but there are not enough data to experiment and really study the relationship in detail. Therefore, I wrote this computer simulation program to allow students to allow them to modify properties of organisms and watch how it will effect the balancing of species' population.

In this manner, SAVANNA for Windows was written to be used in the classroom, but there are some game-like quality that allows this program to be used for entertainment. What ever the actual usage, I hope that you'll find this program useful and enjoyable

Installation

Movement patterns

Reproduction(Birthrate)

Main Window

Virtual Field

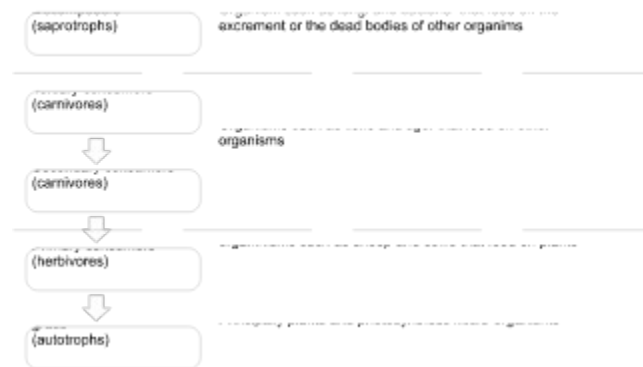
Creating your own Organism

Miscellaneous

Liability

# FOOD CHAIN

Community of organisms are delicately balance with their physical environment.



Most organisms feed at different levels (for example omnivores such as monkeys feed on both plants and animals). Thus, the relationship between organisms form a complex net rather than a simple chain shown above. However, this simulation is based on a simple chain model.

## INSTALLATION

1. This program is written in Visual Basic Ver.2.0 (Japanese) with Visual Control Pack. To execute the program, following files are necessary:

1. **VBRJP200.DLL** (available at WUGNET, LIB 6, VBRJP2.ZIP)
2. CMDIALOG.VBX (included)
3. COMMDLG.DLL (included)
4. GRAPH.VBX (included)
5. GSWDLL.DLL (included)
6. GSW.EXE (included)

Please down-load VBRJP200.DLL file if it is not already installed in the system. Other files are all included in the SV9410.LZH file.

2. Copy these files to the **WINDOWS\SYSTEM** directory.

3. Please move following files to a directory.

SAVANNA.EXE  
SAVANNA.HLP  
SAVANNA.INI  
SVNCHARA.DAT  
FISH.BMP  
SHARK.BMP  
ANOMALO.BMP  
DINOSAUR.BMP  
LION.BMP

3. Execute **SAVANNA.EXE** from the File Manager or the Program Manager to start the program.

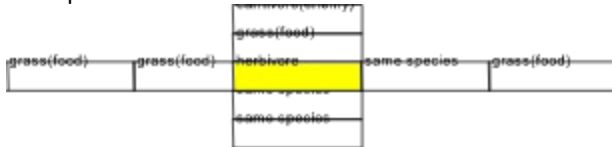
# Movement Patterns

Organisms movement are random. Some organisms will stay still for a period of time while others will move continuously. They will move in a random direction when there are no other object within 2 cells in all 4 directions. When an organism encounters some object (e.g. water or some other organism) blocking its path, it will turn 90 degree to its side.

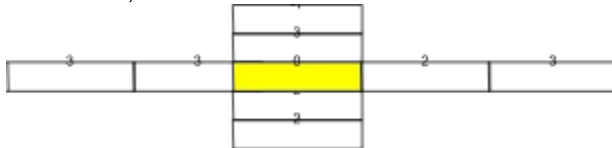
When there is an object within 2 cells in either of 4 directions, it calculates which way it moves using the following algorithm:

1. Check 2 steps above, right, below, left of its current position.
2. If there is an animal of the same species, add 2 points.
3. If there is food (grass for herbivores and herbivores or carnivore of a different species for carnivores), add 3 points.
4. If there is an enemy, subtract 7 points.
5. Set the direction to the direction of the maximum point.
6. If 2 or more directions have the same high value, the direction of movement will be selected randomly from these directions.

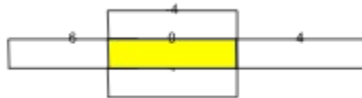
Example:



In this case,



or



In the above example, the organism will move to the left.

When an organism moves, it requires some energy and loses some of its life points. On the otherhand, when it eats something, it gains energy and increases its life points.

Grass will spread or will pollinate and sprout at a new place.

## Reproduction

Organisms of a same species have a same color. A male is marked with a letter **m** or a dot on its back. Females do not have any marking.

An off-spring is reproduced when a female, which has eaten at least once and which have not yet reproduced the maximum number of off-springs, meets a male of the same species face to face.

Current reproduction rate is displayed at the bottom of the screen. This rate is calculated as follows:

When a female dies, a number of off-spring it reproduced is added to the total number of offsprings. This number is then divided by the the number of female that have died. Therefore, reproduction rate first appear after a first female has died.

Each off-spring occupies an unique cell next to its mother. Therefore, only 3 off-springs may be reproduced at once since the father occupies the fourth cell. This number is reduced even further when there is an another organism next to a mother. In this way, female can not reproduce if they are surrounded on all 4 sides and reproduction rate will decrease as population density increases. Furthermore, as the population density increases, food shortage also occurs and increase the death rate.

## Main Menu



This is the main SAVANNA window from which most directions are given. Following commands are supported.

File

Global

Species

Start

Stop

Graph

Options

Information

## **FILE**

Followings file operations are supported:

Open...

Save

Save As...

Printer Setup

Exit

Open a SAVANNA data file (files with SVN extension).



Save all the current SAVANNA parameters to a currently opened data file. If no files are opened, this operation is the as **Save As....** and asks for a file name. (Append SVN file extension)

Save all the current SAVANNA parameters to a new data file. (Append SVN file extension)

Open the Printer Setup dialog box before printing.

Printer Setup was used instead of Print to allow users to modify settings to allow graph and color setting to be modified.

Exit SAVANNA for Windows.

Current species will be saved in the SAVANNA.INI file, but other parameters will not be saved. Save parameters to a data file before exiting if they are to be re-used.

## Global

Common SAVANNA parameters are set from this dialog box.

To change a parameter, check the box next to the parameter to be changed and use the scroll bar at the bottom of the window to change its value.

Please choose the **OK** button after changing parameters to save changes and make them effective.

Number of species

Initial vegetation area

Vegetation growth rate

New growth area

Number of lakes (islands)

Size of lakes (islands)

Set the number of species (1 to 7).

If a number of species is increased, **Species Properties** dialog box is displayed to define properties of the new species. Please choose the **OK** button after setting all properties and to open the **Species Parameters** dialog box which is used to define detailed species characteristics.

Set how much percentage of the field is vegetated at the start of the simulation.

Set how much percent of a grass propagates to its surroundings.

A patch of grass spreads randomly to it surrounding 4 cells, which does not contain water or an organism.



Set how much percentage of the total area sprouts new vegetation after 1 year of simulation.

Set number of lakes (or number of islands) to be placed on the "Virtual Field". They are used to impede migration of organisms.

Set the size of lakes (or islands).  
Maximum size is the smallest dimension of the Virtual Field.

## Species

Species parameters are defined from this dialog box. To define a parameter, use the scroll bar at the bottom of the window to increase or decrease the number. Choose the **OK** button after all parameters have been defined.

0:Herbivores 1:Carnivores

Initial count

Size of a group

Average life span

Increase life after a meal

Decrease in life after movement

Maximum number of off-spring per creature

Maximum distance per step

Rest period after a meal

Set the selected species type (either as herbivores or carnivores).

Set the initial number of organisms to be placed on a virtual field.

Radius of a group of a species at the beginning of a simulation. This is used to set the density (grouping) of the organism.

If number of organisms is set too large to make all organisms fit within a set radius, radius will automatically be increased.

Set the average life span of the species. During the simulation, an organisms average life span will be within 20% of this figure.



Set a number of life span to increase after food consumption. This number correspond to added energy an organism acquires after consumption of food.

Set the number to decrease the life span of an organism when its moves. This number corresponds to how much energy an organism uses when it moves.  
When the life decreases to 0, an organism dies and is removed from the Virtual Field.

Set the maximum number of off-springs a species' female is capable of reproducing during its life time. If a maximum off-spring count is set greater than 3, a female is not capable of reproducing them at once and will reproduce in multiple occurrences.

Set how many cells the selected species is capable of movings at once.

Set time between feeding. This option is only applicable to carnivorous animals.

If it is set to 0 or 1, a carnivores will just devour all other organisms and die from starvation after other species becomes extinct.

## Start

Create a Virtual Field with lakes, islands, vegetations, and organisms are created in the defined manner and start the simulation. Followings commands may be executed during a simulation.

- Increase or decrease number of species
- Make a carnivore appear (used to reduce number of herbivores)
- Display a graph
- Change organisms
- Save parameters to a data file

However, if [Option]-[Virtual Field size] or [Auto demonstration] is selected, new simulation will start after terminating the current simulation.

## **Stop**

Stop the simulation.

It is still possible to display a graph after stopping the simulation.

## Graph

Population status is displayed as a line graph.

Following 4 buttons may be chosen:

1. Copy to the Clipboard      Copy the graph to the clipboard.  
It can be pasted to a drawing tool.
2. Print in black and white      Print the graph in black and white.
3. Print in color      Print the graph in color or in shades.
4. OK      Close the Graph window.

Graph is sized to fit the maximum number of animals and vegetation. If an area is mostly vegetated with few organisms, however, it might not be easy to see and track the animals population. In this case, the maximum size of a graph can be adjusted by moving the vertical scroll bar located at the right of the graph. Moving this bar will change the white numerals at the lower right hand side of the windows. This number corresponds to the graph size. Choose the "G" button located at the right of the graph to re-draw the graph in the new size.

### WARNING:

1. Graph may only be drawn when 2 simulation years has past and when (number of species + 1) times simulation period is greater than 3,800.

Example:

Number of species	Period (years)
7	475
6	542
5	633
4	760
3	950
2	1,266
1	1,900

2. Maximum simulation period is 2,000 years.



## Options

Following is the general simulation options:

Virtual Field size

Change an organism

Simulation speed

Auto demonstration

Always on top

Set the size of the **Virtual Field size**.

Possible virtual field sizes are listed at the top of the dialog box. Use the horizontal and the vertical scroll bar at the bottom of the window to change the field size or choose the **[Maximum]** button to automatically set the virtual field to the maximum size possible. After making the change, choose the **OK** button to save the change or the **[Cancel]** button to cancel making a change.

**WARNING:**

Changing the size of a virtual field will terminate the current simulation.

Select an organism to add to the virtual field.

Select **File Name** to open the file with the name of the organism you want to use. 5 organisms are pre-defined, but new organism can be created and added to the available list. (There may be up to 10 organisms.) Refer to [Creating Your Own Organism](#) for further details.

Set speed of simulation (Default speed is set to [Medium])

Simulation speed may be set to [Fast],[Medium], and [Slow] but there is not too much noticeable speed difference within the SAVANNA program itself. This setting effects CPU usage and will change speed of other concurrently running programs.

### Auto Demonstration

Toggle between auto demonstration and user specified simulation modes.

When this option is selected, the current simulation is terminated and a new simulation is repeatedly started with semi-random parameters. Simulation will automatically start a new simulation with new virtual field after 200 to 400 simulation years.

To exit auto demonstration mode, re-open the **Options** dialog box uncheck the [Auto demonstration] option.

### NOTE:

Selecting **[New]** stops the current simulation and starts a new simulation.

Check this option to always display Virtual Field on top of other windows.

## **Information**

Following information are displayed at the bottom of the windows.

Organism count

Birth rate

Time and cell

Number of organisms are displayed below the image of each species. Number of vegetation is displayed below the "0".

Simulation ends when population all organisms reaches 0 (i.e. they all become extinct).



Reproduction rate are displayed below number of organisms.

Reproduction rate is calculated as follows:

When a female dies, a number of off-spring it reproduced is added to the total number of offsprings.

This number is then divided by the the number of female that have died. Therefore, reproduction rate first appear after a first female has died.

The current simulation year is displayed to the right. One simulation year is the minimum time interval that all organism in a field is given a turn to exhibit some action. Maximum simulation year is limited to 2,000 years.

Total number of cells, an amount of space occupied by an organism, is displayed at the lower right of the window. In SAVANNA for Windows, all organisms are assigned 1 cell.

## **Virtual Field**

Virtual Field is where simulation is displayed. When SAVANNA for Windows is started, it is displayed below the Main window. (Try double-clicking within the Virtual Field.)

## **Creating Your Own Organism**

5 species are pre-defined, but it is possible to have up to 10 species by defining your own species.

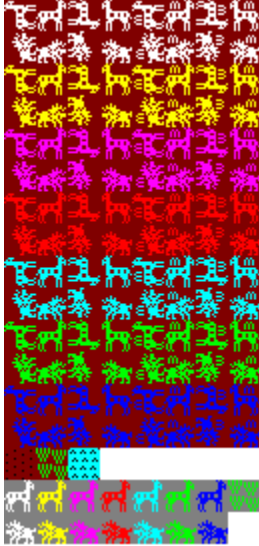
[Creating a bitmap image](#)

[Defining the "SVNCHARA.DAT" file](#)

[Eurypterids and Trilobites](#)

## Creating a Bitmap Image

Bitmap images used in SAVANNA are drawn in the following format:



1. Bitmap images BMP files that are 128 dots wide and 272 dots high using 16 color palette. They may, however, be made bigger or with more colors. Nevertheless, even if they are made bigger, only 128x272 dots rectangle from the top left hand side are used. Furthermore, only up to 256 colors may be displayed.
2. Grey color of the background at the lower side is the background color of the main window. RGB are all set to 128 (&H80 in hexadecimal). It is recommended that this color be used to make your animal's background match the main window's background.
3. Low intensity red at the background of the top of the window is the background color of the Virtual field. If the field is aqueous, blue is used instead of red.
4. Animal should be 16 by 16 dots.

It may be difficult to draw an animal using the Paintbrush. It is recommended that some bit map editor be used instead.

Once bitmap images are created, define their names in the SVNCHARA.DAT file.

## Geologic Time Scale

Era	Period	Beginning of period (millions of years)	Organisms
Cenozoic	Quaternary	2-3	Ice age, modern plants and animals
	Tertiary	70	Mammals, flowering plants
Mesozoic	Cretaceous	135	Dinosaurs, bony fishes, aquatic reptiles
	Jurassic	180	Dinosaurs, birds, primitive mammals
	Triassic	225	Early dinosaurs, forests
Paleozoic	Permian	270	Early reptiles, amphibians, primitive forests
	Carboniferous	350	Amphibians, primitive fishes, insects
	Devonian	400	Lung fishes, primitive land plants
	Silurian	440	Jawless fishes
	Ordovician	500	Corals, clams, snails, starfishes, algae
	Cambrian	600	Trilobites, brachiopods, marine plants
Precambrian		>3000	

There are excellent exposures of Cambrian fossils in the province of Alberta in the Canadian Rockies. Ripple-marked quartzites and shales contain fossil remains from the Lower Cambrian period.

Furthermore, Middle Cambrian remains are preserved in the Cambrian Burgess Shale in British Columbia.

## Defining the **SVNCHARA.DAT** file

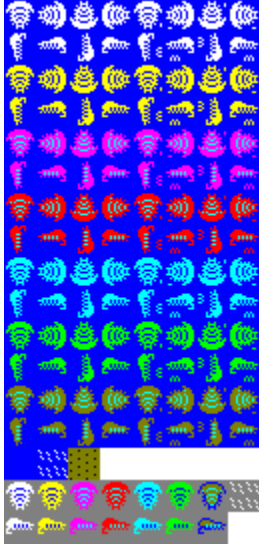
By default, the "SVNCHARA.DAT" file contains the followings:

```
-----  
LION.BMP  
Vegetation  
Zebra  
Lion  
DINOSAUR.BMP  
Vegetation  
Brontosaurus  
Tyrannosaurus  
ANOMALO.BMP  
Plankton  
Trilobite  
Eurypterid  
SHARK.BMP  
Plankton  
Fish  
Shark  
FISH.BMP  
Diatom  
Water flea  
Fish  
-----
```

1 set of data consists of 4 rows.

First row is the file name. Second row is the vegetation. Third row is the Vegetarian. Fourth row is the carnivorous animal. End each row with a return (Enter).

By default, 5 sets of data are defined. Up to 10 sets of data may be defined. Once a bit map of a new character is drawn, add it to the SVNCHARA.DAT file using an editor.



## Eurypterids and Trilobites

Within the pre-defined organisms, there may be some who do not know about eurypterids and trilobites. This section will provide a simple explanation of these organisms.

Eurypterid and trilobite existed in the Cambrian period. Trilobites were the most common organism and accounts for 60% of fossils in this period. Over 10,000 sub-species are known from the fossil remains.

Eurypterids also existed during the Paleozoic era. They had pairs of chelicerae (pincerlike structures) which they used to grab its prey and 4 to 5 pairs of walking legs. They seems to have become extinct 225 million year ago. The only remaining member of a similar class is the present horseshoe crab.



## Miscellaneous

"SAVANNA for Windows 94.10a" is a **FREE SOFT**.

SAVANNA for Windows may be freely distributed if the following conditions are obeyed:

1. If it is to be copied to another forum or to another distribution channel, please contact the developer to let us know exactly where it is to be copied. We will need this information to maintain and upgrade SAVANNA for Windows at all locations.
2. This program can be distributed only in the original archived SV9410.LZH formatted file. Do not change this file or any files within.
3. Please make it apparent that SAVANNA for Windows is a FREE SOFT. It is necessary to state this in the program description.
4. If this program is to be mentioned in any article, please send a E-mail to one of the developers.

If it is going to be distributed in any other ways (e.g. CD-ROM), please contact the developer. The developer is willing to discuss other means of distribution. Please send a mail to one of the E-mail addresses in the support section below.

### Releases

94.10 94.10a  
-Fix to properly display in 120dpi resolution.  
-Fix few minor details

### Acknowledgement

SAVANNA for Windows 94.10a is based on **VB Wizard** by Yasuhiro Umeki. I want to thank him for providing me with this programs as well as other programs without which this program would not have been possible.

I also want to thank people who wrote the **Life** game. They have inspired me to write this program.

### Development Environment

Self assemble AT compatible machine  
Mother Board: Asustec VL  
CPU: 486DX2-66Mhz  
Video Card: Stealth 24 VLB  
HDD: W.D. IDE 420+340M

Support for SAVANNA Screen Saver is provided by CompuServe E-mail. If you have any question, opinion, suggestions, or any other comments, please send an E-mail to:

Hitoshi Ozawa	CompuServe:	100220,3402
Shinji Hara	Nifty-Serve ID:	PDE01357

## **Liability**

The author and the developer of this software will not take any responsibilities for any damages that may occur with the use of this software. The files contained in SV9410.LZH are distributed "as is" and without any expressed and implied warranties. The user assumes the entire risk of using the software.

