

ArcGIS® 9

Animation in ArcMap™ Tutorial



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DATA CREDITS

Tutorial data: Contiguous USA population attribute data from 1800–2000. Source: U. S. Census Bureau.

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Animation in ArcMap Tutorial

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- **Exercise 2: Viewing an animation**
- **Exercise 3: Creating a temporal animation**
- **Exercise 4: Animating data in a graph through time**

Animations can be created in ArcMap™, ArcScene™ or ArcGlobe™. Animations allow you to effectively visualize and analyze your data by changing display properties of layers, the camera, or the map extent. By altering layer properties, such as the time slice that is displayed or layer visibility and transparency, you can create interesting animations that can be used to analyze data through time or to view information in various layers. By altering the extent (ArcMap) or the camera position (ArcScene or ArcGlobe), you can create an animation that moves around a map, scene or globe. Examples of applications that would benefit from being viewed as an animation include:

- The occurrence of events through time, such as hurricanes or precipitation, the spread of a disease, or population change
- The movement of an object, such as a car, through a landscape
- Visualizing information in multiple layers by applying transparency

In this tutorial, you'll learn how to create an animation that shows layer attributes changing with time in the display and in a graph. The steps in this tutorial can be applied to any supported data type (feature class, raster catalog, NetCDF) and as a guide when animating your own layers or tables through time. Time layer animations can be created in the same way in ArcScene and ArcGlobe, so you can animate your layers through time in those applications as well.

To use this tutorial, ArcGIS® must be installed and you must have the Animation in ArcMap tutorial data installed on a local or shared network drive on your system. Ask your system administrator for the correct path if you do not find it at the default installation path specified in the tutorial.

Exercise 1: Organizing your data in ArcCatalog

Since you'll make changes to the Animation in ArcMap folder and will therefore need to have write access to the data within the folder, you will begin this exercise by making a working copy of the Animation in ArcMap tutorial folder. You will use ArcCatalog™ to browse to and copy the folder.

Copying the tutorial data

1. Start ArcCatalog by either double-clicking a shortcut installed on your desktop or using the Programs list on your Start menu.
2. If the Location toolbar is not present, click View, Toolbars and click Location.
3. Click the Location combo box and type the path to the \arcgis\ArcTutor folder on the drive where the tutorial data is installed. Press Enter.



4. Right-click the Animation in ArcMap folder and click Copy.
5. Right-click the local drive where you want to place the tutorial data (for example, C:\) and click Paste. The folder is copied to your local drive.

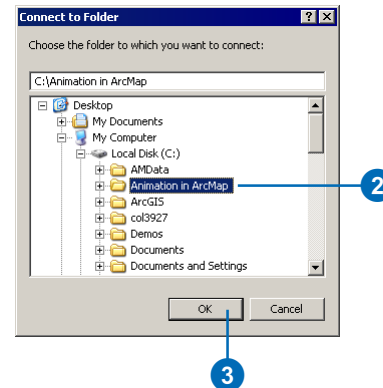
Connecting directly to your tutorial data

In ArcCatalog, folder connections allow you to access specific directories on local disks or shared folders on the network.

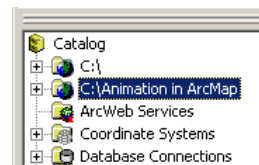
1. Click the Connect To Folder button.



2. Navigate to and select your local copy of the Animation in ArcMap tutorial folder.
3. Click OK.



The new folder connection is listed in the Catalog tree. You will now be able to access all the data needed for this tutorial via the new connection.



4. Click File and click Exit.

Exercise 2: Viewing an animation

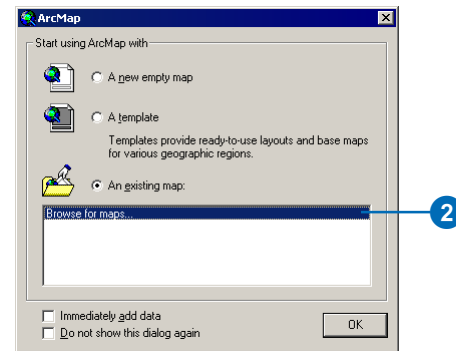
Visualizing changes in data over time can reveal information about historical patterns and future potential change. Data that can be animated through time includes netCDF, raster catalog, and feature class layers. Once the data source for any of these layers is added to the application as a layer, the steps for setting up the temporal animation are the same.

In this exercise, you'll animate feature class layers to examine population change. You'll open an existing map document containing an animation and play it. You'll examine changes in recorded county and state population figures over time for a number of states in the USA, from the year 1800 to the year 2000. You'll examine county population data in the ArcMap display and state population data in a graph. In exercises 3 and 4, you'll create the animation from scratch to learn the sequence of steps that are involved.

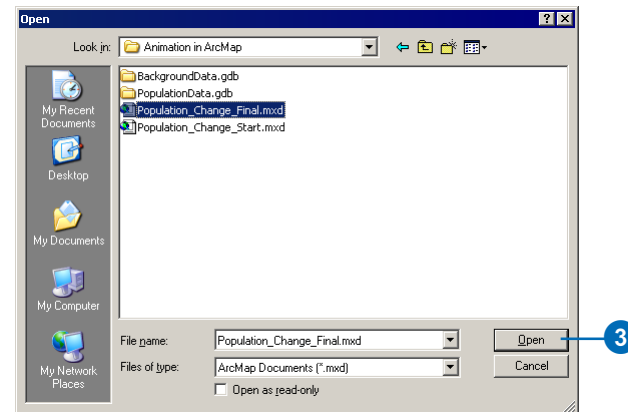
Opening an existing map document

You'll begin by starting ArcMap and opening a map document containing the final animation that you will create in exercises 3 and 4.

1. Start ArcMap by using the Programs list on your Start menu.
2. If the ArcMap startup dialog box appears, check An existing map, then double-click Browse for maps. If you previously checked Do not show this dialog again on the ArcMap startup dialog box, open the map document by clicking Open instead.



3. Navigate to the Animation in ArcMap folder on your local drive, click Population_Change_Final.mxd, then click Open.

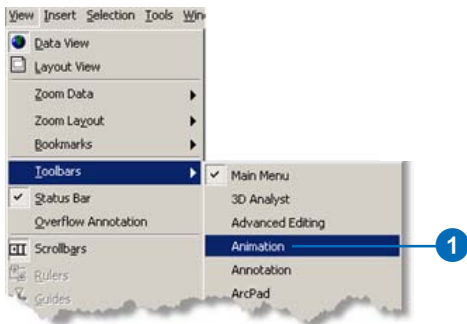


A map of population figures per county and a graph displaying population figures by state are displayed.

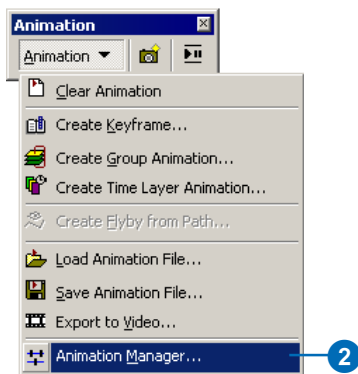
Playing the animation

You'll now play the animation to gain an understanding of what can be achieved by animating data through time.

1. Click View, point to Toolbars, then click Animation.

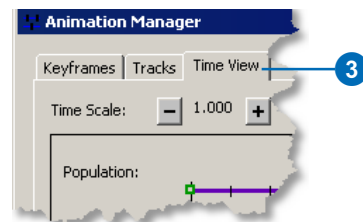


2. Click the Animation drop-down arrow and click Animation Manager.

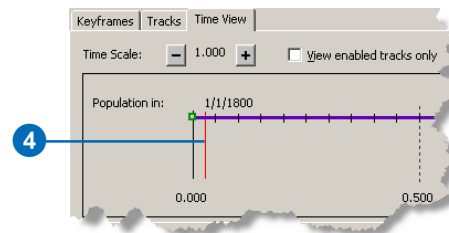


3. Click the Time View tab.

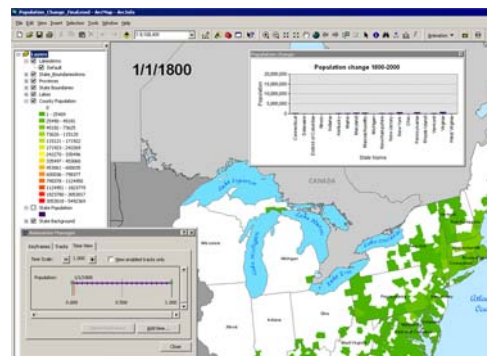
The Time View tab allows the time slices of an animation to be previewed.



4. Click in the Time View display area (in the position shown by the red time slider in the graphic below) to view the population figures recorded in the 10-year period after 1800.

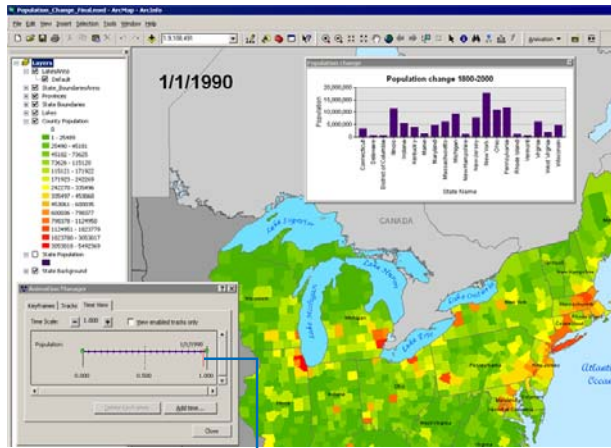


5. Resize or move the Animation Manager so you can see the counties in the display and the states in the graph that were recording population figures at this time.

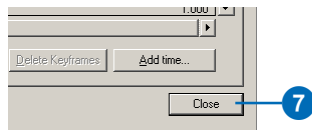


The format of the displayed time text is dependent on your computer's regional time settings, so your time text format might be slightly different than that in the graphic.

- Click in the Time View display area (in the position shown by the red time slider in the graphic) to view population figures recorded in the 10-year period after 1990.



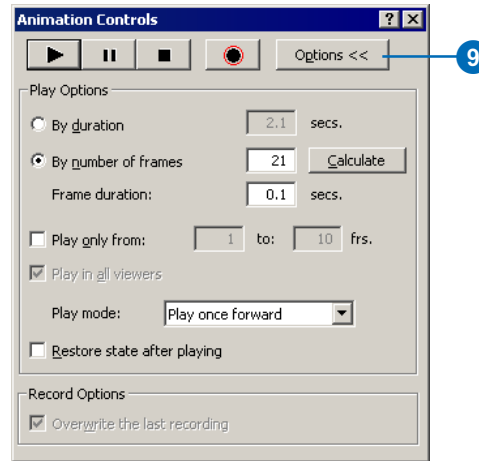
- Click Close on the Animation Manager.



- Click the Open Animation Controls button.



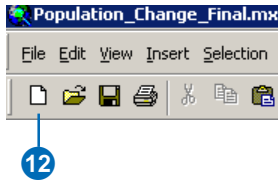
- Click Options and check that your Play Options are the same as those in the graphic below.



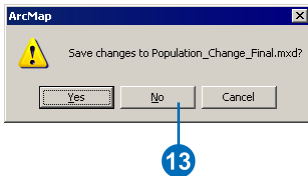
- Click Options to collapse the dialog box, then click the Play button to see the animation play in the ArcMap display and in the graph.



11. Click Close (“X”) on the Animation Controls dialog box.
12. Click the New Map File button.



13. Click No when asked to save the map document.



In this exercise, you opened an existing map document containing an animation, previewed time slices, and played the animation to examine county population data in the ArcMap display and state population data in a graph. In exercises 3 and 4, you'll create the animation from scratch to learn the sequence of steps that are involved.

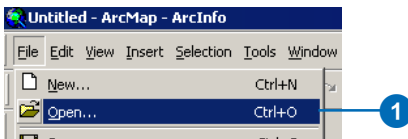
Exercise 3: Creating a temporal animation

The procedure for creating an animation through time is the same in ArcMap, ArcScene, and ArcGlobe.

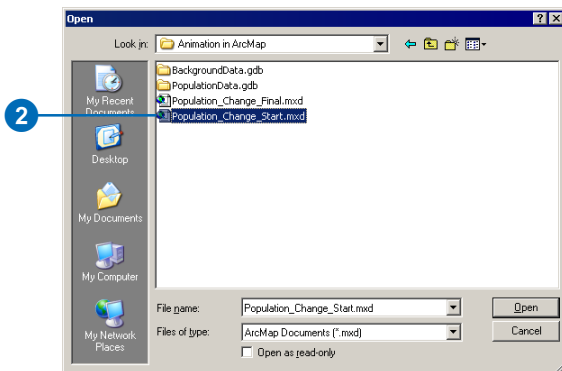
In this exercise, you'll work in ArcMap and create an animation to view changes in recorded county population over time for a number of counties in the USA, from the year 1800 to the year 2000. You'll use the County Population feature class layer, and you'll animate it in the ArcMap display.

Opening the map document

1. Click File and click Open.



2. Navigate to your Animation in ArcMap folder and double-click Population_Change_Start.mxd.

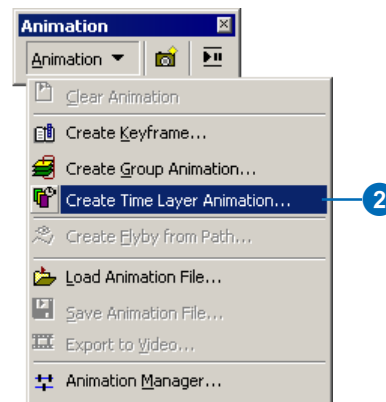


The map contains background layers, and two layers containing population information: State Population and County Population. These two layers contain population figures recorded from the year 1800 to 2000, in 10-year increments.

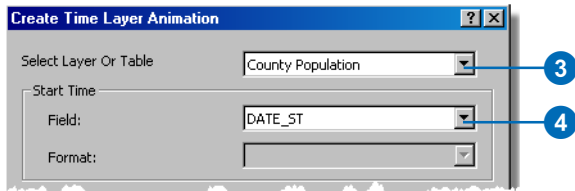
Creating a time layer animation

Feature class, netCDF (feature and raster) and raster catalog layers can be animated in the display of ArcMap, ArcScene, or ArcGlobe. All that is required is a field with time values in the attribute table, or a time dimension for netCDF layers. Here you'll use the Create Time Layer Animation dialog box to create a time layer animation in the display, using a feature class layer as input.

1. If the Animation toolbar isn't present, click View, Point to Toolbars and click Animation.
2. Click Animation and click Create Time Layer Animation.



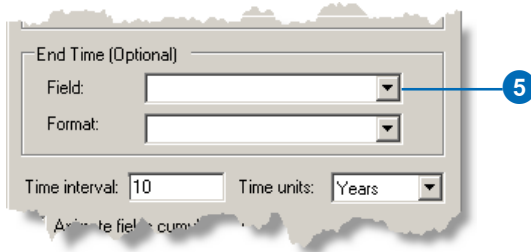
3. Click the Source Layer or Table drop-down and click County Population since this is the layer that will be animated.
4. Click the Field drop-down and set DATE_ST as the time field to use in the animation.



Since this is a date field, the Format drop-down is disabled. If the field specified was a string or numeric field that contained date strings such as “2000/01/01” you would need to specify the field format.

Note that since the time steps in the County Population layer are every 10 years (regularly spaced), an End Time Field is not necessary. For irregularly spaced time steps, you may need to specify an End Time Field. This can be created as a pre-processing step using the Calculate End Date tool in the Fields toolset under the Data Management Tools in the ArcToolbox window.

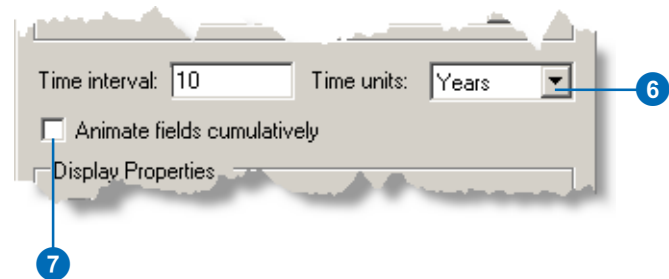
5. Leave the End Time Field option blank.



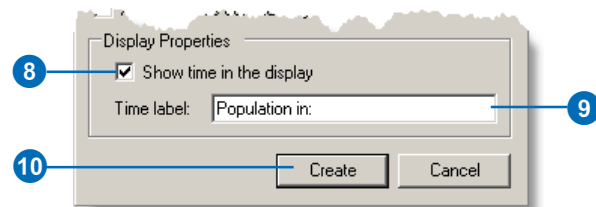
6. Set the interval and units to use to display time slices to 10 years.

The Animate fields cumulatively option enables you to retain data in the display that has been drawn, enabling you to see progression, such as the accumulation in the extent of a wildfire.

7. Leave the Animate fields cumulatively option unchecked.



8. Check Show time in the display. The time text for each time slice will display as the animation is played or previewed.
9. Type a label that will appear before the time text in the display as the animation is played or previewed.
10. Click Create to generate the time layer animation.

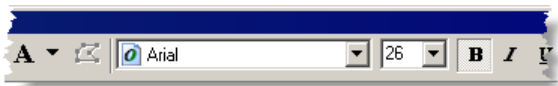


11. Click File on the Main menu and click Save.

Playing the animation

Before playing the animation, you'll set the text font and size for the time text that will display.

1. If the Draw toolbar isn't present, click View, point to Toolbars, and click Draw.
2. Set the text font to Arial, 26pt, bold.



3. Click the Open Animation Controls button.

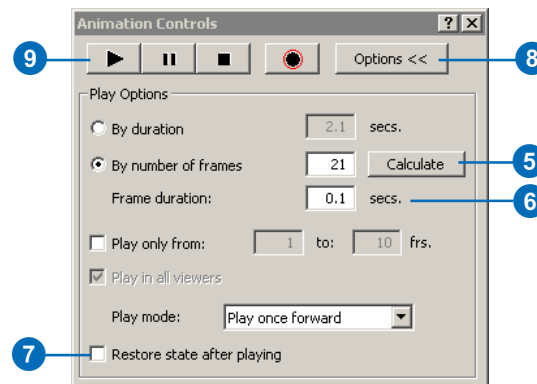


4. Click Options.



5. Click By number of frames and click Calculate.
6. Set the Frame duration to 0.1.

7. Uncheck Restore state after playing so that the original state of the data before the animation was played is not restored after the animation has played. The final time slice and time text will be retained.
8. Click Options to hide the play and record options so you can see the animation in the display.
9. Click the Play button.



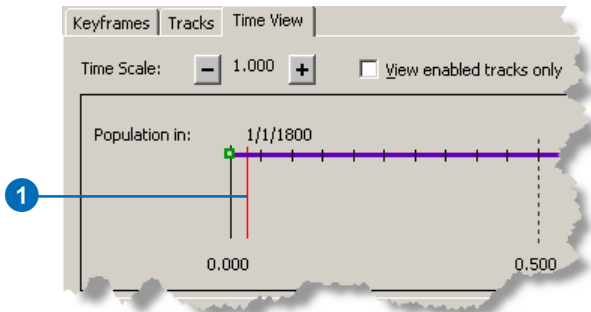
Examine the increase in recorded population over time.

10. Click File on the Main menu and click Save.

Previewing time slices

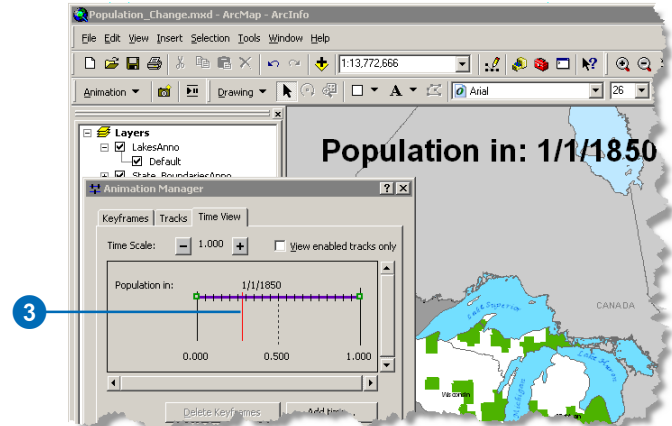
You can preview slices of your animation on the Time View tab of the Animation Manager.

1. Click the Time View tab and click in the location shown to expose the red slider, and to view the recorded county population in the year 1800.



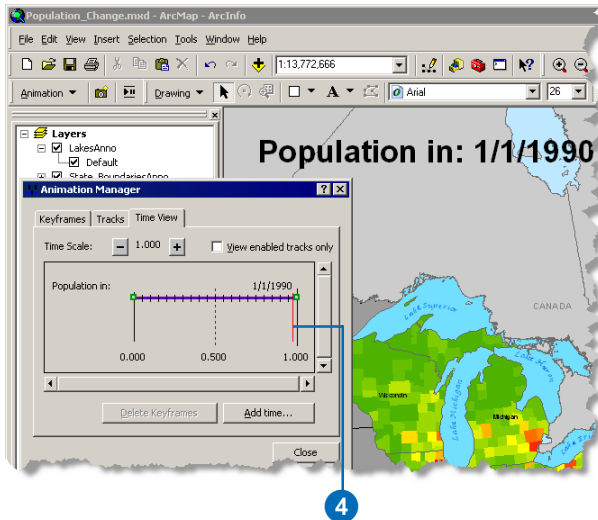
The space between each tick mark on the track line represents each 10-year period. After the second tick mark, the time slice displayed will change from 1800 to 1810. Note the animation time (from 0.000 to 1.000) at the bottom of the Time View display. All tracks operate within this animation time.

2. Click the edge of the Animation Manager and resize it smaller so you can see more of the display.
3. Click in the location shown on the Time View tab display to view the time slice for 1850.



Notice that many more counties are recording population as time goes by.

- Click in the location shown on the Time View tab display to view the time slice for the 10-year period after 1990.

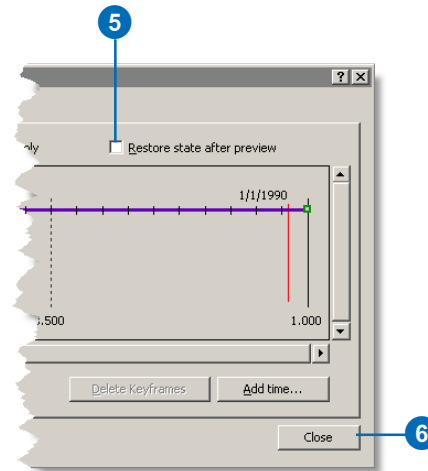


Notice that the recorded population for all counties has grown substantially.

With Restore state after preview checked, closing the Animation Manager would remove the time text and the layer would go back to its original state. The current definition query set to show the time slice for 1990 would be removed.

- Ensure that Restore state after preview is unchecked so that the currently displayed time slice will be retained in the display after the Animation Manager is closed.

- Click Close.

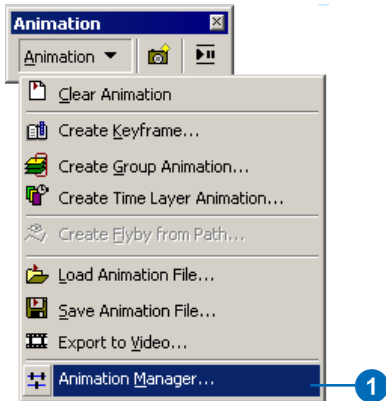


- Click File and click Save to save your map document up to this point.

Viewing track and keyframe properties

In the Animation Manager, you can view and edit the track and keyframe properties of the animations you have created. All animations consist of tracks. Tracks are bound to objects (such as layers, the map view [ArcMap], the camera [ArcScene and ArcGlobe], or the scene [ArcScene]) whose properties can be animated. Tracks are composed of keyframes, which are a snapshot of the object's properties at a certain time during the animation. For time layer tracks, each keyframe stores a time, and the interval (such as 10) and units (such as years) that will be applied between that keyframe and the next one. You'll view the animation track you've created and look at its keyframe properties in the Animation Manager.

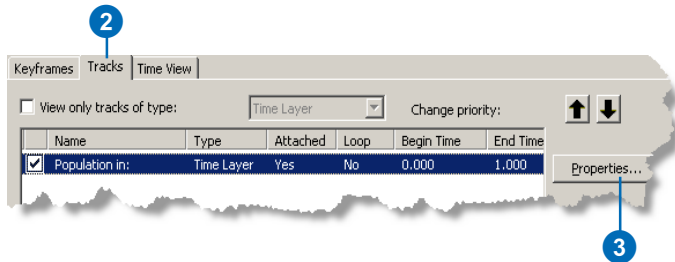
1. Click Animation and click Animation Manager.



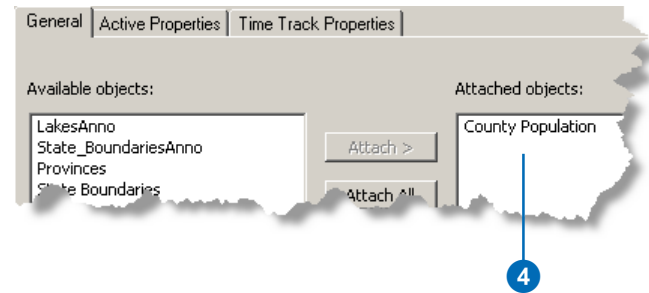
2. Click the Tracks tab.

The track you created using the Time Layer Animation dialog box is listed.

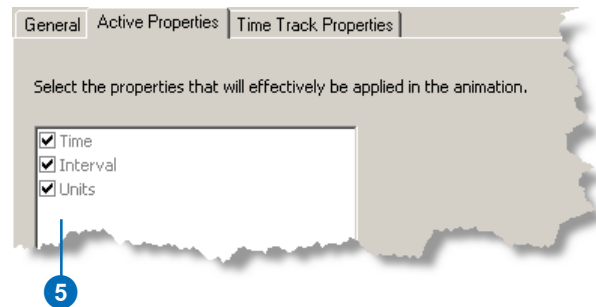
3. Click the track to select it, and click Properties to view the properties of the track.



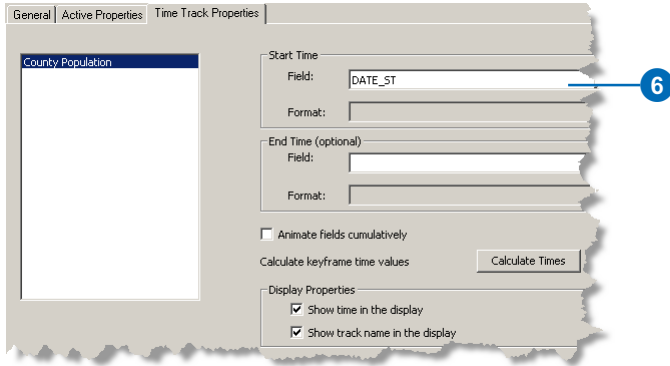
4. Click the General tab to view the layer that is attached to the track. In the next exercise, you'll attach another layer to this track, so both layers will animate at the same time.



5. Click the Active Properties tab to view the properties that will be applied in the animation. For time layer tracks, properties cannot be unselected, since all properties must be applied in the animation.



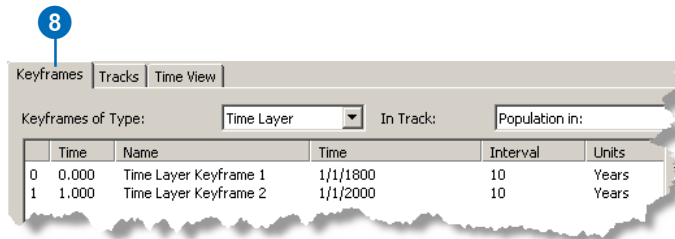
- Click the Time Track Properties tab to view the time field and other options you specified on the Create Time Layer Animation dialog box.



In the next exercise, you'll set track properties for the second layer you'll attach to this track.

Note that if a time field is altered here, you can click Calculate Times to set the minimum and maximum time values in the field as the time values for the track's keyframes.

- Click OK on the Track Properties dialog box.
- Click the Keyframes tab to view the keyframe properties that you specified.



Notice that by default, two keyframes were created when you clicked Create on the Create Time Layer Animation dialog box. The time range is set by default to the minimum and maximum time values from the field. Between these keyframes, time slices will display, based on the interval and units you specified (every 10 years).

- Click File on the Main menu and click Save.

This exercise showed you how to create, play, and preview time slices of, a temporal animation in the map display. In the next exercise, you'll learn how to animate a layer in a graph at the same time.

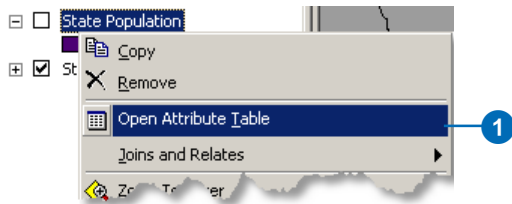
If you're moving on to the next exercise, keep the map document open. If you want to stop and continue later, close the map document and reopen it to continue with exercise 4.

Exercise 4: Animating data in a graph through time

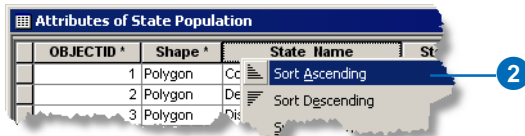
In this exercise, you'll create a graph from the State Population layer to examine total population figures per state over time. You'll attach the layer as a secondary source for the track. The data in the graph will then animate along with the data in the display. You'll be able to spot general trends by viewing the state population figures in a graph.

Examining the attribute table

1. Right-click the State Population layer and click Open Attribute Table to examine the population figures.



2. Right-click the State_Name field and click Sort Ascending.



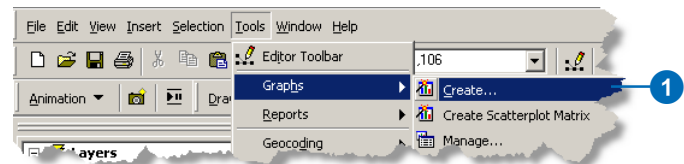
3. Scroll down the table and notice that the population for all states is being recorded during the first half of the 1800s.
4. Close the table.

OBJECTID	Shape	State_Name	Start_Date	Population	Shape_Len
440	Polygon	West Virginia	1/1/2000	1808344	1791287.7
21	Polygon	Wisconsin	1/1/1800	0	2026517.86
42	Polygon	Wisconsin	1/1/1810	0	2026517.86
63	Polygon	Wisconsin	1/1/1820	1444	2026517.86
84	Polygon	Wisconsin	1/1/1830	3635	2026517.86
105	Polygon	Wisconsin	1/1/1840	30945	2026517.86
126	Polygon	Wisconsin	1/1/1850	305391	2026517.86
147	Polygon	Wisconsin	1/1/1860	775881	2026517.86
168	Polygon	Wisconsin	1/1/1870	1054670	2026517.86
19	Polygon	Wisconsin	1/1/1880	1310000	2026517.86

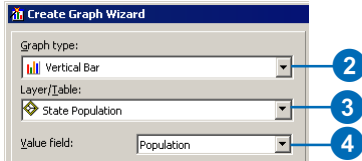
Creating a graph

In ArcMap, feature class layers, netCDF feature layers and tables, dBASE® tables, and geodatabase tables in a personal, file, or ArcSDE® geodatabase can be animated in a graph. Here you'll create a graph using a feature class layer.

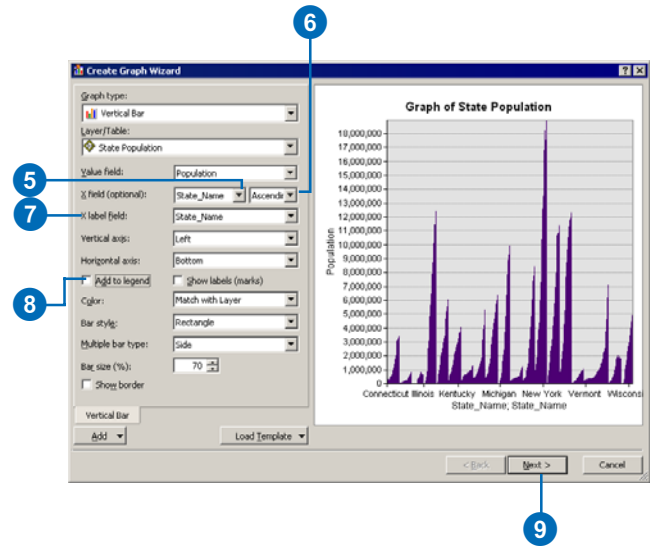
1. Click Tools on the Main Menu, point to Graphs, then click Create.



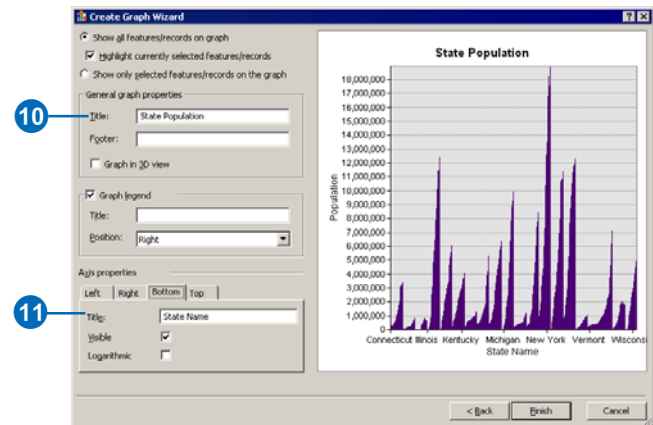
- Click the Graph type drop-down arrow on the Create Graph Wizard and click Vertical Bar.
- Click the Layer/Table drop-down arrow and click State Population.
- Click the Value field drop-down list and click Population to set this as the value for the y-axis.



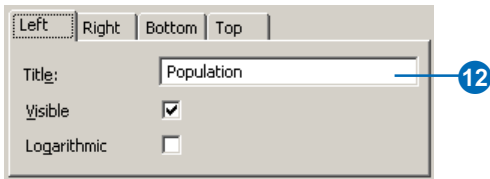
- Click the X field drop-down arrow and click State_Name to set this as the value for the x-axis.
- Set Ascending for the X field so that the state names will be displayed in ascending order.
- Set the X label field to State_Name.
- Uncheck Add to legend so the legend is not displayed in the graph.
- Click Next.



- In the General graph properties frame, type “State Population” in the Title text box.
- Type “State Name” in the Title text box on the Bottom tab.

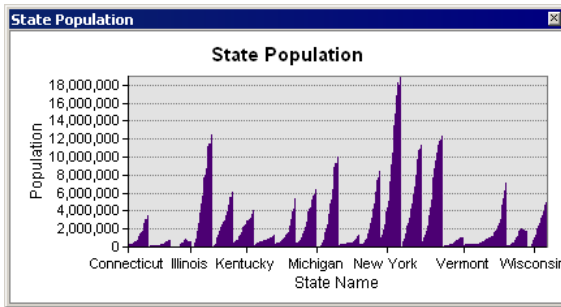


- Click the Left tab and check that Population is set as the title for the Y Axis.



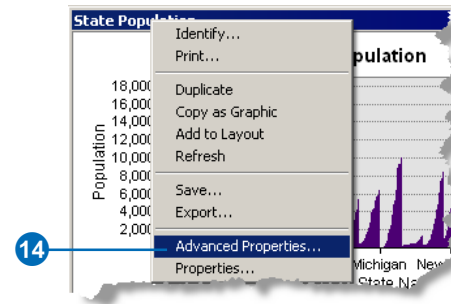
- Click Finish.

A graph is created displaying the total population values for each state through time. Once the graph is animated later in this exercise, you'll be able to see the population value per state change as each time slice is displayed.



Notice that it is not possible to see all the state names on the X Axis, even if you expand the graph. You'll rotate the state name labels to overcome this problem.

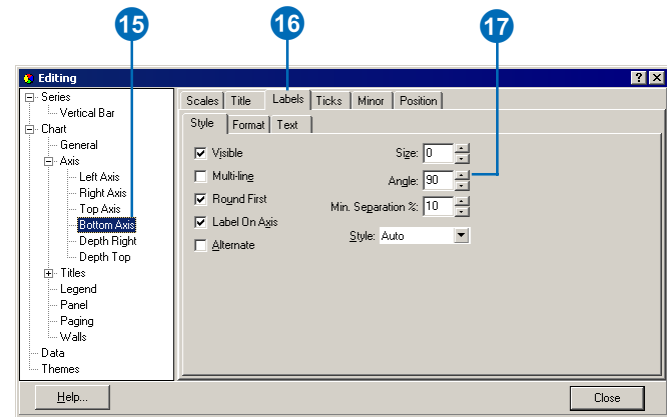
- Right-click the graph and click Advanced Properties.



- Expand Chart, then expand Axis and click Bottom Axis.

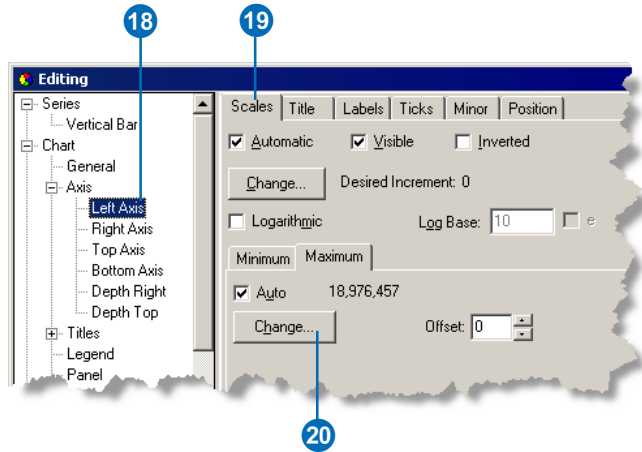
- Click the Labels tab.

- Click the Style tab, and increase the Angle value to 90 degrees. Examine the effect this has on the graph's x-labels.

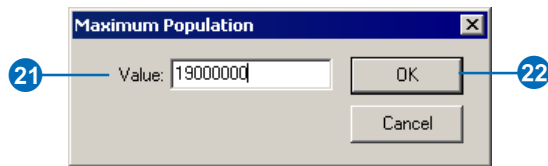


You want the range of y-values in your graph to remain the same and not fluctuate depending on the data, so you'll fix the maximum y-value.

18. Click Left Axis in the Editing tree on the left side of the Editing dialog box.
19. Click the Scales tab.
20. Click the Maximum tab and click Change.



21. Type “19000000” in the Value text box.
22. Click OK.

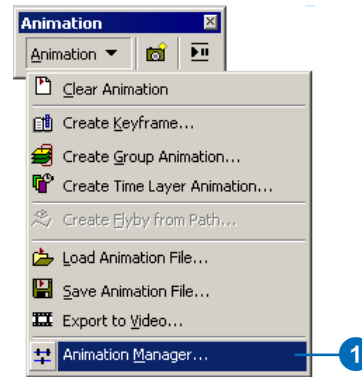


23. Click Close on the Editing dialog box.
24. Click File and click Save.

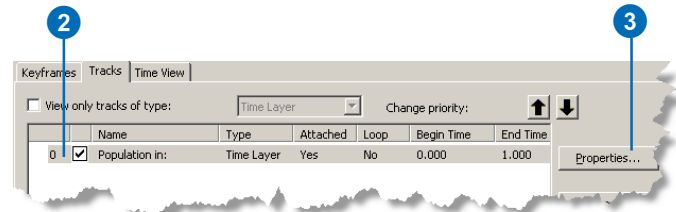
Attaching the State Population layer to the time layer track

You'll now add the State Population layer as another attached object to the time layer track you created in exercise 3. Doing so will enable the data in the graph (the State Population layer) to animate at the same time as the data in the display (the County Population layer). Another way to achieve this result is to create another time layer track and attach the State Population layer to it.

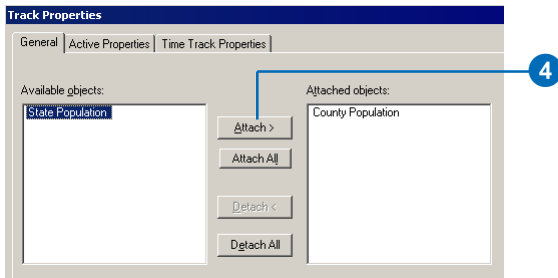
1. Click Animation and click Animation Manager.



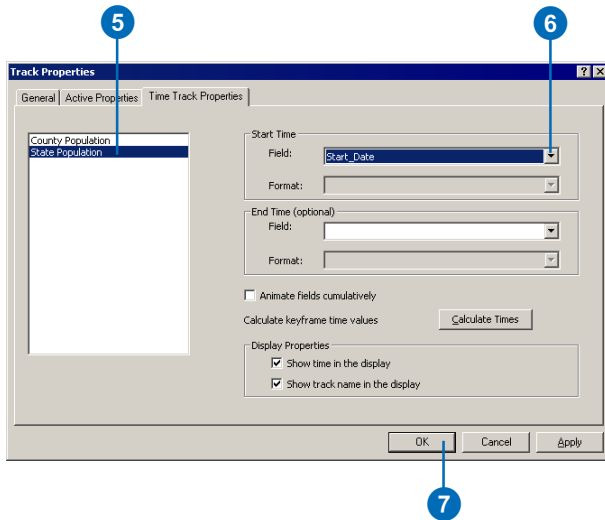
2. Click the Tracks tab and click the track to select it.
3. Click Properties.



- Click the General tab, click State Population from the Available objects list, then click Attach.



- Click the Time Track Properties tab and click State Population.
- Click the Start Time Field drop-down arrow and click Start_Date.
- Click OK.



- Click Close on the Animation Manager dialog box.
- Click File on the Main Menu and click Save.

Playing the animation in the graph and the display

Your animation is now ready to play in both the graph and the display.

- Click Options on the Animation Controls dialog box to expand the Play options part of the dialog box.
- Ensure that Restore state after playing is unchecked so the last frame will be retained after playing the animation. Also check the number of frames that will display is 21, and the frame duration is 0.1.
- Click the Play button.



Examine the recorded population changes over time in the display and in the graph.

Exporting the animation to a video file

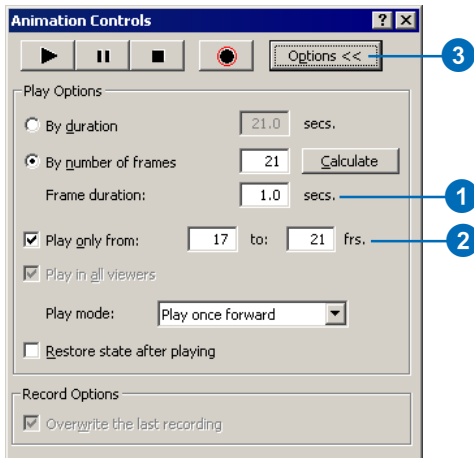
Many times, you'll need to present your animation to others. Rather than playing the animation in the display of the ArcGIS application, you can create a video of your animation by exporting to an Audio Video Interleaved (.avi) or QuickTime (.mov) file. This is especially useful when working with large datasets where the refresh rate can be slow, and it enables you to share your animations with others. Videos can take time to create, especially with large datasets, but once created, the video runs quickly.

The video will play too quickly with the currently set frame duration of 0.1.

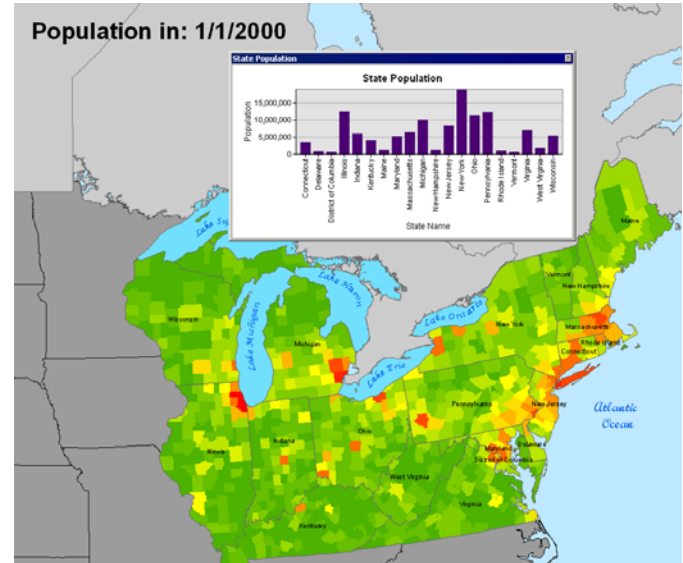
1. Set the Frame duration on the Animation Controls dialog box to 1.0 second.

You'll only export the time range from 1950–2000.

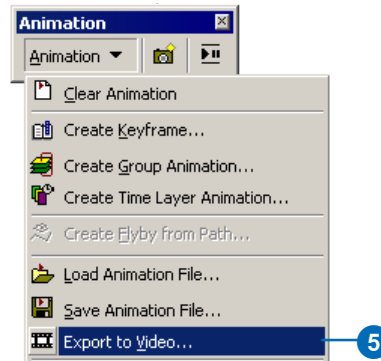
2. Check Play only from and type "17" to "21" frames.
3. Click Options to collapse the Animation Controls dialog box.



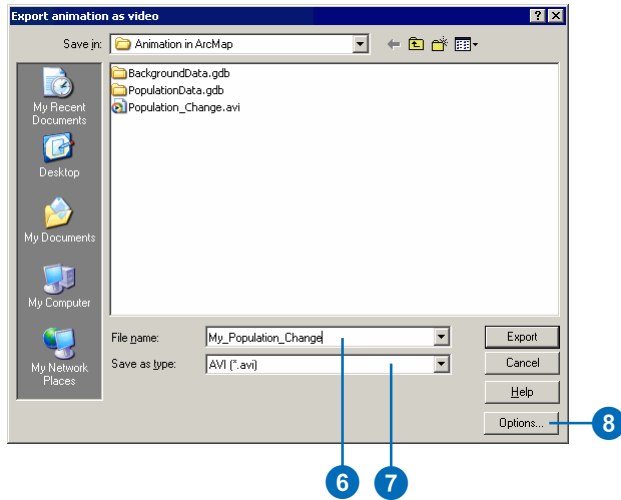
4. Ensure that the graph is large enough to show all the state names, but small enough so that all the counties and the time text can be seen in the display.



5. Click the Animation drop-down arrow and click Export to Video.

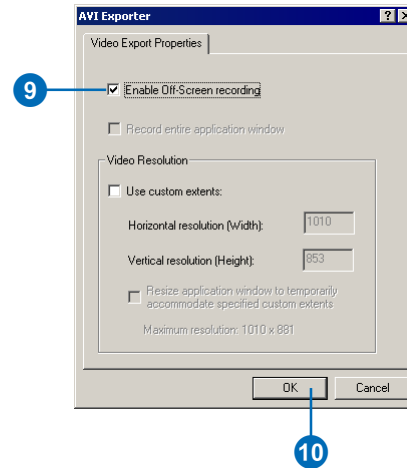


6. Navigate to your Animation in ArcMap folder and type “My_Population_Change” in the File name text box.
7. Leave the default in the Save as type drop-down list as AVI (*.avi).
8. Click Options.

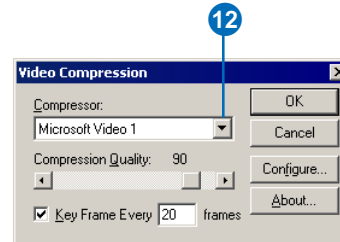


The Enable Off-Screen recording option is useful if you want to continue working while the animation is exporting. With the exception of graphs, windows opened on top of the ArcMap application will not appear in the exported video. The graph you created will be exported and included in the video file if you check Enable Off-Screen recording.

9. Check Enable Off-Screen recording.
10. Click OK.



11. Click Export on the Export animation as video dialog box. The Video Compression dialog box opens.
12. Click the Compressor drop-down arrow and choose a compressor.



Compressor/decompressors (codecs) are third party software, which greatly reduce file size while maintaining optimum quality. There are usually different codecs on different machines, depending on the types and versions of video creation, editing and viewing software installed.

For Microsoft® Audio Video Interleaved (AVI), Full Frames, Uncompressed is arguably the best codec, giving a high-quality video output. The resulting video size on disk could be very large however, since there is no compression applied. Of the codecs that apply compression, Cinepak Codec by Radius and Microsoft Video 1 have been used with good results.

For Apple® QuickTime® (QT), most of the QT codecs listed should work well since QT has regular upgrades. Cinepak, Sorenson Video, H.264 (noted for its high compression), and MPEG-4 have all been used with success.

Note that you can export animations from layout view in ArcMap, enabling you to export not only the display and the graph but also layout elements, such as the legend for the data in the display, a north arrow, scale bar, and so on.

13. Since it may take some time to create the video, click Cancel and navigate on disk to your Animation in ArcMap folder. Double-click Population_Change.avi to play a video that has previously been created.
14. Click File and click Save to save the map document.
15. Click File and click Exit to exit the ArcMap application.

This brings you to the end of this tutorial. You've learned how to create an animation that shows layer attributes changing with time in the display and in a graph. These steps can be applied to any supported data type so use this tutorial as a guide when animating your own layers or tables through time. Time layer tracks can be created in the same way in ArcScene and ArcGlobe, so you can animate your layers through time in those applications as well.

Other types of animations can be built by creating different track types. You can build a map view track to create an animation that moves around, and zooms in on, the map. You can build a layer track to create an animation that alters layer transparency or visibility. A scene track allows you to animate scene properties, such as the background color. These tracks can be built and animated alongside a time layer track to create visually interesting animations.

To learn more about creating animations, see the 'Animation' section of the ArcGIS Desktop Online Help system.

