

**POPULATION DYNAMICS**  
**Connecting Past, Present and Future**  
A Four-Part Curriculum

**PART A**  
**Push and Pull Forces in Settling America**

by  
**Jennifer Anderson**  
**Jeff Potash**

**POPULATION DYNAMICS**  
**Connecting Past, Present and Future**  
**A Four-Part Curriculum**

<http://clexchange.org/curriculum/complexsystems/populationdynamics/>

**PART A**

Push and Pull Forces in Settling America

**PART B**

Push and Pull Forces in U.S. Colonial History

**PART C**

U.S. Urbanization from 1820-1920

**PART D**

America's Baby Boom and Global Youth Bulge

## POPULATION DYNAMICS – PART A

### Push and Pull Forces in Settling America

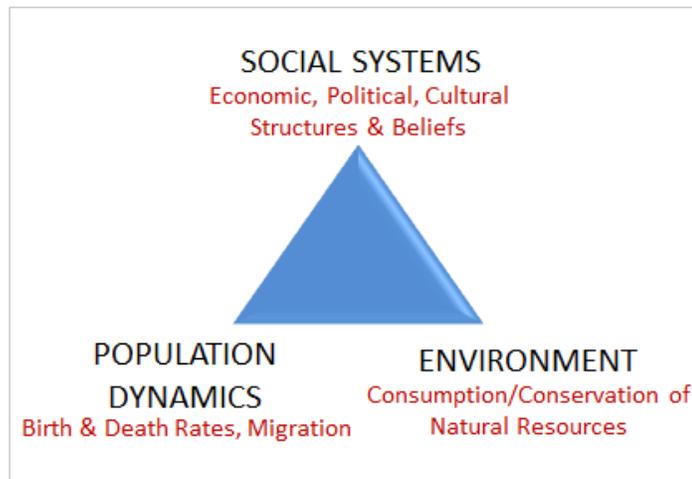
#### TEACHER INSTRUCTIONS

#### OVERVIEW

*While the settlement of New England is seen as a beginning for American history, it is also a part of the history of England, which, in preceding centuries, had been subject to dramatic changes in population. Together with environmental and social factors (e.g., economy, religion, culture, identity), these patterns help us understand major developments in America’s past. Similar dynamics, involving changing birth and death rates, are occurring in many countries across the globe today, raising important implications for the future. This lesson asks students to evaluate the relative importance of PUSH factors that cause people to leave their homes (e.g., war, disease, limited job opportunities) and PULL factors in the settlement of the Massachusetts Bay Colony (e.g., better opportunities, self-determination, friendly locals, or beautiful scenery).*

Following guided handouts, students use three computer simulations to investigate the significance of population change in United States history and on the modern world. The computer simulations are supplemented with a variety of primary and secondary sources, and students are challenged to reconstruct and experiment with long-term patterns of population change (based on births and deaths). Additionally, students can apply the principles of historical population dynamics to current and possible future events.

These lessons can be done either during or outside of class time, or within a flipped classroom context. They provide a frame to help students conceptualize how populations change, and how those changes are can affect social systems and environments while also being affected by them (graphic on right). Using multiple resources and structured problem-solving, these lessons encourage students to connect historical trends, structures, and relationships with real-world present and future challenges.



## INTRODUCTIONS TO SIMULATIONS/STUDENT ACTIVITIES

<http://clexchange.org/curriculum/complexsystems/populationdynamics/popdynA.asp>

### **Simulation 1: How Do Populations Change over Time?**

In this introductory Sim, students explore the implications of different birth and death rates on long-term issues of population growth and sustainability within a fictional, present-day community. *NOTE: We highly recommend completing this Sim before undertaking Sim 2 or 3.*

#### **Students will:**

1. Use a simple demographic simulation to create scenarios of their own choosing (varying initial populations, birth and death rates).
2. Analyze and interpret graphical output to demonstrate full understanding of different patterns of long-term population change.

### **Simulation 2: Were English Puritans Pushed Out of England or Pulled to New England?**

Students work through a simulation exercise reconstructing how changing death rates in England impacted the English population in the period leading up to the settlement of New England. A diverse collection of primary and secondary sources relating to environmental, economic, cultural and religious themes challenges students to reconstruct how these factors interacted to shape events in England and in Colonial America.

#### **Students will:**

1. Use a timeline of important events and a graph of England's changing population between 1300-1650 to discuss possible factors that may have influenced the colonization of New England (1620-30).
2. Use a demographic simulation to identify death rates at three critical moments in English history (1300, 1400, and 1500) that account for England's changing populations throughout the 350 year period between 1300 and 1650.
3. Use primary and secondary historical sources to describe how changes in the English population were connected to environmental and economic transformations.
4. Explore issues of globalization, religion, culture, the colonization of New England and the creation of an American identity.

### **Simulation 3: What Population Challenges Do Modern Nations Face?**

Students use current UN data on birth and death rates in countries around the world to explore and compare possible future population developments.

#### **Students will:**

1. Examine and select current demographic data (populations, birth and death rates) from countries across the world.

2. Apply their understanding of demographic change to explore current demographic developments and their implications on possible futures.

*NOTE: Each of the three simulations includes a student handout with instructions and prompts for written responses intended to challenge students to document and explain their learning.*

## STANDARDS AND METHODS

This lesson strives to address three important sets of standards:

### 1. Content:

**The College Board** identifies twelve major themes that *encourage students to think conceptually about the American past and to focus on historical change over time.*<sup>1</sup>

- A. Sim 2 (*Were English Puritans Pushed or Pulled to New England*) highlights the following themes: demographic changes, economic transformations, environment, globalization, religion, culture and the American identity.
- B. Sim 3 (*What Challenges Do Modern Nations Face?*) further connects themes of past demographics with future issues involving globalization.

### 2. Method:

**The Common Core Standards** stipulate that students learn to integrate information from both primary and secondary sources to forge *a coherent understanding of an idea or event, noting discrepancies between sources.*<sup>2</sup>

- A. Sim 2 includes graphs, together with diverse primary and secondary sources, for students to reconstruct multifaceted elements of change that contribute to the decision of English Puritans to settle New England. Students actively reconstruct a past where population change is both the *result of* and the *agent for* change in other areas including the economy and environment.

### 3. Relevance:

**The National Council For Social Studies** specifies the need to *empower students to make connections between learning and their world, to support active citizenship.*<sup>3</sup> This lesson encourages students to explore their changing demographic world and to assess impacts of change on their lives.

---

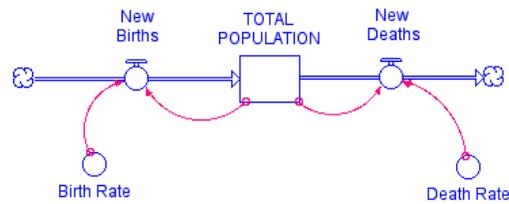
<sup>1</sup> <http://apcentral.collegeboard.com/apc/public/repository/ap-us-history-course-description.pdf>

<sup>2</sup> <http://www.corestandards.org/ELA-Literacy/RH/11-12/> for 11-12<sup>th</sup> Grade English/Language Arts standards involving teaching History

<sup>3</sup> <http://www.socialstudies.org/standards/execsummary>

## FOR THOSE INTERESTED: HOW DOES THE SIMULATION MODEL WORK?

Each of the three simulations uses a system dynamics model similar to the one below.



Much like a demographer, the model starts with a TOTAL POPULATION (box in the center). That population changes annually with New Births (people flowing into the population) and New Deaths (people flowing out).

The model calculates these flows based on two factors shown as arrows leading into new births and deaths:

1. One is the demographers' so-called "Birth Rate" and "Death Rate." These rates are numbers, typically between 5 and 50, that refer to the number of births or deaths per thousand people in the total population.
2. Multiplying this rate by the total population determines the specific number of new births and new deaths.

$\text{New Births} = \text{Birth Rate (\#/1000)} \times \text{total population}$

$\text{New Deaths} = \text{Death Rate (\#/1000)} \times \text{total population}$

As a result of these core structures, populations change in nonlinear and often explosive ways. Where a birth rate exceeds a death rate, the total population grows at an ever-rising pace. That's because new births and the total population work in a cyclical relationship called a "reinforcing feedback loop": more births cause more people, which causes more births, which causes... Understanding this pattern, one of many oft-repeated in history, further informs what is happening in many places today with further implications for the future.

© 2015 Creative Learning Exchange, [www.clexchange.org](http://www.clexchange.org)

*Working in K-12 education to develop Systems Citizens*

Permission granted for copying and for electronic distribution for non-commercial educational purposes

## Teacher Guide – Part A, #1

### How Do Populations Change Over Time?

*This handout guides you through a problem-solving exercise that introduces you to “birth rates” and “death rates” and their roles in shaping patterns of population change over time.*

<http://clexchange.org/curriculum/complexsystems/populationdynamics/popdynA.asp>

#### STEP 1. Familiarize Yourself with the Introduction

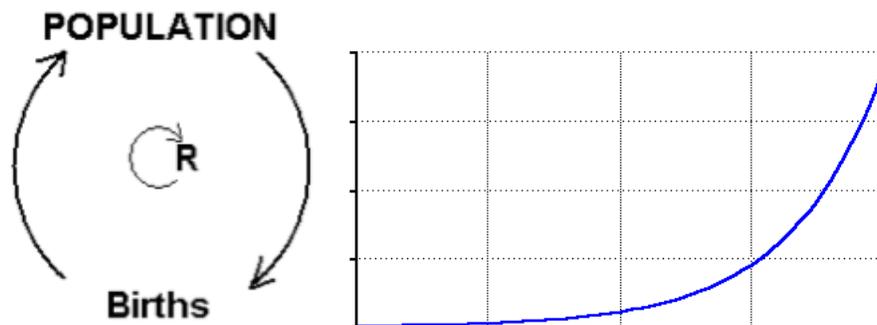
Open and read each of the links. Define what demographers mean by:

Birth Rate:

Death Rate:

Demographers’ define birth rates and death rates as a number per 1000 population (typically between 10 and 50). You may want to show students some examples to connect to previous learning about percentages, e.g., an annual birth rate of 30/1000 is equivalent to 0.03 or 3% per year.

What happens if the rates are different? If the birth rate is greater than the death rate, the population grows. Over time, the pace of growth accelerates, as a growing population generates a larger number of births (even if birth rates are constant). This, in turn, leads to a still larger population, a larger number of births, and so on. This cycle (shown below) is referred to as a “reinforcing feedback loop”, and, if left unchanged, can create explosive growth over long periods of time (like the one shown).



### PUSH and PULL Dynamics:

Push and pull refer to the movement of people from one place to another. People experiencing major difficulties, either due to a lack of resources/opportunities (e.g., jobs, food, land) or political unrest, often feel a push to leave. People who are not experiencing difficulties but who see better opportunities elsewhere are said to be pulled into a new place.

The larger importance of push and pull dynamics rests in the movement of people from one place to another, something that has shaped the past (as in the case of the Puritan settlement of America), the present (see map in Push and Pull Dynamics), and the probable future.

### STEP 2. How Do Different Birth and Death Rates Affect Population Change?

Open Sim 1 and read the instructions on Page 2. Start with an initial population of 1000. Run the simulation three times, comparing different birth and death rates (Runs #1-3). Then change the initial population to 3000, and repeat, using the same birth and death rates (Runs #4-6). Record all of your results below.

Initial Population: 1000

#1

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

#2

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

#3

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

Initial Population: 3000

#4

Same Birth Rate as #1

Same Death Rate as #1

FINAL POPULATION: \_\_\_\_\_

#5

Same Birth Rate as #2

Same Death Rate as #2

FINAL POPULATION: \_\_\_\_\_

#6

Same Birth Rate as #3

Same Death Rate as #3

FINAL POPULATION: \_\_\_\_\_

The simulation helps students discover the relationships between birth and death rates. While the specific results vary based on specific student choices, they should see patterns where:

1. the greater the difference between birth and death rates, the faster the growth. (NOTE: Only if births exceed deaths.)
2. the larger the population, the greater number of births.

### **STEP 3. Assess What You've Learned**

Using the data you've created, compare those runs where the population did *not* exceed the number that could be supported (10,000) to those that did. What factors caused the population to exceed 10,000? What long-term strategy or strategies would you recommend for a population of 1000 *not* to exceed 10,000? Would the strategy be the same for a population of 3000? Use the back of this sheet to explain.

Students should be able to identify two major factors affecting population growth within supportable limits:

1. the difference between birth and death rates.
2. the initial size of a population.

Discovering that significantly higher birth rates than death rates lead to long-term explosive growth in a population may raise questions about where and when this has occurred in the past and in the present. The next two simulations will address this issue. However, if students are interested in learning more about birth and death rates after using this simulation, they may discover that over the course of most of human history relatively close rates have been the norm. (On a global basis, it took upwards of 150,000 years for the human population to reach 1 billion in 1800, which translates into a birth rate during that period less than .1 per 1000 greater than the death rate!) There have been episodes, particularly involving catastrophic events, where deaths exceed births, though obviously a long-term continuation of this pattern could result in extinction! Only in the recent past, notably with the major strides in health care, have death rates fallen. The consequences have been profound.

NAME \_\_\_\_\_

**Student Guide – Part A, #1**  
**How Do Populations Change Over Time?**

*This handout guides you through a problem-solving exercise that introduces you to “birth rates” and “death rates” and their roles in shaping patterns of population change over time.*

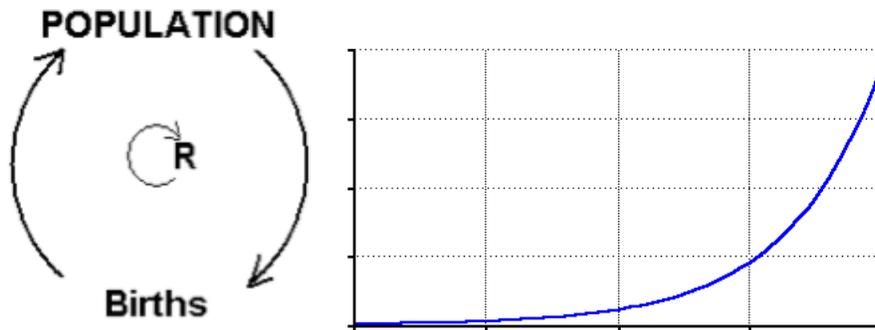
<http://clexchange.org/curriculum/complexsystems/populationdynamics/popdynA.asp>

**STEP 1. Familiarize Yourself with the Introduction**

Open and read each of the links. Define what demographers mean by:

Birth Rate:

Death Rate:



## STEP 2. How Do Different Birth and Death Rates Affect Population Change?

Open Sim 1 and read the instructions on Page 2. Start with an initial population of 1000. Run the simulation three times, comparing different birth and death rates (Runs #1-3). Then change the initial population to 3000, and repeat, using the same birth and death rates (Runs #4-6). Record all of your results below.

Initial Population: 1000

#1

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

#2

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

#3

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

Initial Population: 3000

#4

Same Birth Rate as #1

Same Death Rate as #1

FINAL POPULATION: \_\_\_\_\_

#5

Same Birth Rate as #2

Same Death Rate as #2

FINAL POPULATION: \_\_\_\_\_

#6

Same Birth Rate as #3

Same Death Rate as #3

FINAL POPULATION: \_\_\_\_\_

## STEP 3. Assess What You've Learned

Using the data you've created, compare those runs where the population did *not* exceed the number that could be supported (10,000) to those that did. What factors caused the population to exceed 10,000? What long-term strategy or strategies would you recommend for a population of 1000 *not* to exceed 10,000? Would the strategy be the same for a population of 3000? Use the back of this sheet to explain.

## Teacher Guide – Part A, #2

### Were English Puritans Pushed Out of England or Pulled to New England?

*This handout guides you through a series of problem-solving exercises that:*

- *Allows you to simulate how changing birth and death rates affected England's population between 1300 and 1660, and*
- *Use that information, together with primary and secondary sources on changing environmental and social systems, to assess the reasons underlying the Puritan settlement of New England.*

<http://clexchange.org/curriculum/complexsystems/populationdynamics/popdynA.asp>

**NOTE:** If students did not work with Sim 1, please make sure they read ALL of the material in the Introduction, as it explains how demographers use birth and death rates to calculate population change. As presented and discussed in the Sim 1 handout, students should be able to define “Birth Rate” and “Death Rate” and explain the conditions that give rise to PUSH or PULL dynamics of movement into and out from select populations.

#### **STEP 1. How Did England's Population Change Between 1300 and 1650?**

Open Sim 2. Describe what you see happening in England between 1300-1650 in the graph and timeline. How is the population changing over time? What is your theory about what caused the pattern shown on the graph?

The graph of England's population reveals three patterns:

1. roughly a century of continuous population decline (1300-1400).
2. a century during which the population remains stable (1400-1500).
3. a century during which the population rebounds to a bit more than where it had been in 1400.

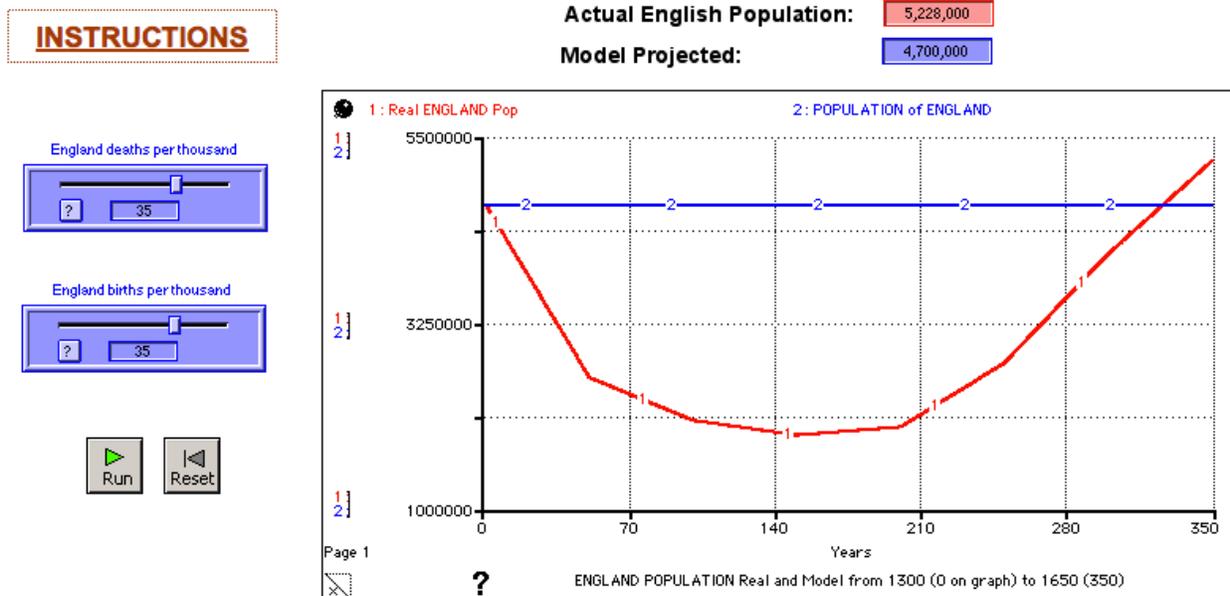
The “Great Events” (culled from a standard textbook) transposed on the graph offer some insight into the population decline of the 14th century, but less so for the succeeding 250 years. The purpose of this lesson is to help students understand:

1. how populations grow (with birth rates exceeding death rates).
2. how that growth accelerates over time (through a “reinforcing feedback loop,” where larger populations generate greater numbers of births, producing still larger populations and even more births...).
3. how the nonlinear dynamics of changing populations contribute to major events, including wars, economic changes, and migrations.

## STEP 2. What Was Happening to Birth and Death Rates Between 1300 and 1650?

Progress to Pages 2 and 3. RUN the simulation with the birth and death rates, each set in their default position (at 35/1000 population). The graph will show two lines: the “Real English Population” and a line showing what would have happened with identical birth and death rates. Explain why the two lines are different from one another.

When the birth and death rates are identical, the number of people born annually equals the number who die, and the projected population total remains the same (see graph below). The other line shows the actual population over time when birth and death rates were not equal.



Follow the Instructions to see how closely you can match the simulation output with what actually happened. Record your three death rates below:

Death rate between 1300-1400: 43 per 1000 in the population  
 Death rate between 1400-1500: 35 per 1000 in the population  
 Death rate between 1500-1650: 29 per 1000 in the population

**INSTRUCTIONS**

England deaths per thousand

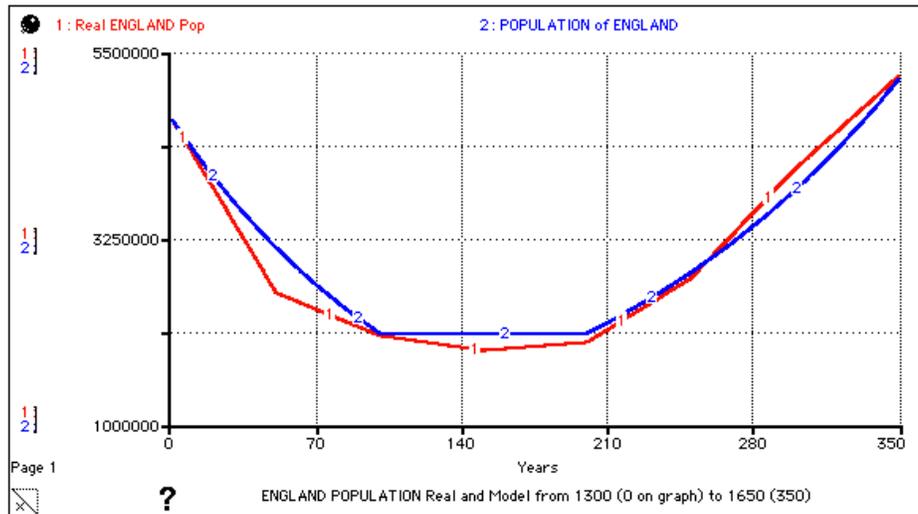
U ? 29

England births per thousand

? 35



Actual English Population: 5,228,000  
 Model Projected: 5,186,645



Keeping the birth rate constant at 35 per thousand and varying the death rate as shown above, the model generates a remarkably close “curve fit” with the graph of the actual events.

- A. What did you notice and learn by working to match your graph to the real historical population of England?
- B. What happened to the death rates in your simulation?
- C. Look back at the events happening during this period. How might they have been connected to the three different death rates? NOTE: you’ll need to infer beyond the event itself to think about the impact that event had on society over time.
- D. How does your conclusion in STEP 2 compare to your original theory in STEP 1 above?
  1. Instead of a “pulse” of high deaths caused by a single event, steady and prolonged decline occurred over the first century (1300 – 1400). Causes included ongoing infectious disease outbreaks and also chronic problems resulting from malnourishment and/or poor sanitary conditions.
  2. During the second century (1400-1500), disease dissipated and other conditions radically improved. One might anticipate deaths falling below births such that the population rebounded. But the death rate did not fall as expected. More information is needed to understand either what may have been keeping deaths high or what was reducing life spans.
  3. After 1500, we do see the expected upturn. This is not a sudden or dramatic “pulse” in population (e.g., Baby Boomers in 20<sup>th</sup> century America), but instead it is a significant, sustained, and ongoing reduction in deaths. That reduction is significant, but the accelerating rate at which the population grows simply reflects the system of natural growth. A growing population translates into more births, larger population, even more births, and so on.

### **STEP 3. Connect Changing Population Dynamics to Changes in the Environment and Social Systems**

Go on to Page 4 in the Sim and review all of the materials that describe what was happening with England’s environment. How does the environment influence English population demographics? How does it work the other way, too, such that the population demographics impact England's environment? Describe below.

Solving problems involves formulating a hypothesis or interpretation based on connecting the evidence available. These sources help students see that changes in England’s population were related to changes in the environment in ways that involved push and pull dynamics. For example, recurring outbreaks of disease (as opposed to a single event), particularly in urban settings, illustrate that populations were vulnerable to ongoing disease (especially infectious diseases) both because of population density and the fact that “new” people in the population (either children or new migrants to cities) were susceptible to recurring disease outbreaks. Disease outbreaks pushed populations down, while new jobs in cities pulled people in from rural environments.

Review Page 5 in the Sim, focusing on England’s economy. How did England's population dynamics impact its economy? And how did the economy in turn affect the population? Describe below.

As the population begins to rebound around 1500, the population of both rural and urban poor rises significantly. That in turn triggers increased crime and new policies for dealing with (and differentiating between) the deserving and undeserving poor. So, too, as many of the rural poor migrate to large cities in search of work, increased competition for jobs causes wages to fall.

### **STEP 4. What Did the “Players” Give as Reasons For Settling?**

Go to Page 6 in the Sim and read the three primary source excerpts from Richard Hakluyt and John Winthrop. What evidence supports a hypothesis that the Puritans were pushed out of England? What evidence supports the position they were pulled to New England? Record each below.

Pushed Out of England

Pulled to New England

Students may present arguments for both the pushed and pulled hypotheses. John Winthrop’s two writings highlight the fact that Winthrop’s religious zeal, with visions of leading his followers to a new Zion, reflected the pull of the newly opened North American continent, an undertaking that harked back to the biblical description of God leading His Children into the Promised Land.

Yet it’s clear, both from Richard Hakluyt’s writing and from Winthrop’s own explanation (Reasons for Emigrating), his followers were also dealing with a set of push factors,

reminiscent of the biblical Exodus. While neither Winthrop nor his followers were poor, jobless, or landless, they saw the disease, the enormous poverty and misery enveloping England. Hence, the interplay between growing populations and England's environment and economy were contributing factors in their decision to leave a weary land and embark on a mission to create a new Jerusalem, a "City on a Hill."

### **STEP 5. Were English Puritans Pushed or Pulled to New England?**

Now it's time to put all of the pieces together. In the course of this simulation, you have been introduced to (a) a changing English population (1300-1650) based on a changing death rate, (b) disease outbreaks, (c) urbanization (a changing environment), (d) poverty/crime, (e) changing wages, prices and jobs (a changing economy), and (f) religious zeal. Can you incorporate all of these into a story that explains in what ways the Puritans were pushed out of England or pulled to New England or both?

This is purposely open-ended to give students an opportunity to make their case as they choose. There is no right answer: rather, there are a set of important developments or cause-and-effect relationships that should be highlighted:

1. Until 1500, England is subject to conditions, notably involving recurring disease outbreaks, where the population falls, then remains stable. During this time, a pattern of urbanization begins as people looking for jobs move from the farms to the cities. While that is important, the central fact is that falling deaths across the country trigger population growth. Initially, that growth is modest, but because of the reinforcing feedback dynamics of population growth, the pattern accelerates over time.
2. Overall population growth triggers a number of new pressures on land and jobs in rural areas, which in turn generate large numbers of rural poor. Many migrate to cities in search of jobs, but the numbers exceed the jobs, and wages fall. The combination of cities' increasingly growing and ever denser populations and terrible health conditions lead to repeated disease outbreaks. Still, rural migrants have no choice but to pour into the cities.
3. The social, economic, and environmental changes that confronted England were not lost on Puritans and others seeking religious change. Hence, the great social movement known as the Puritan Migration was influenced in no small part by a changing death rate that had begun more than a century earlier.

This exercise introduces students to the dynamics of population growth over time and illustrates where and how that growth triggers other developments involving environmental and economic change. The exercise focuses specifically on the analysis and synthesis of factors influencing the settlement of Massachusetts Bay. But the lessons have broad applicability across a wide array of situations in any time frame. Simulation 3 looks at population dynamics in modern nations.

NAME \_\_\_\_\_

## Student Guide – Part A, #2

### Were English Puritans Pushed Out of England or Pulled to New England?

*This handout guides you through a series of problem-solving exercises that:*

- *Allows you to simulate how changing birth and death rates affected England's population between 1300 and 1660, and*
- *Use that information, together with primary and secondary sources on changing environmental and social systems, to assess the reasons underlying the Puritan settlement of New England.*

<http://clexchange.org/curriculum/complexsystems/populationdynamics/popdynA.asp>

#### **STEP 1. How Did England's Population Change Between 1300 and 1650?**

Open Sim 2. Describe what you see happening in England between 1300-1650 in the graph and timeline. How is the population changing over time? What is your theory about what caused the pattern shown on the graph?

#### **STEP 2. What Was Happening To Birth and Death Rates Between 1300 and 1650?**

Progress to Pages 2 and 3 in Sim 2. RUN the simulation with the birth and death rates each set in their default position (at 35/1000 population). The graph will show two lines: the "Real English Population" and a line showing what would have happened with identical birth and death rates. Explain why the two lines are different from one another.

Follow the Instructions to see how closely you can match the simulation output with what actually happened. Record your three death rates below:

Death rate between 1300-1400: \_\_\_\_ per 1000 in the population

Death rate between 1400-1500: \_\_\_\_ per 1000 in the population

Death rate between 1500-1650: \_\_\_\_ per 1000 in the population

**INSTRUCTIONS**

England deaths per thousand

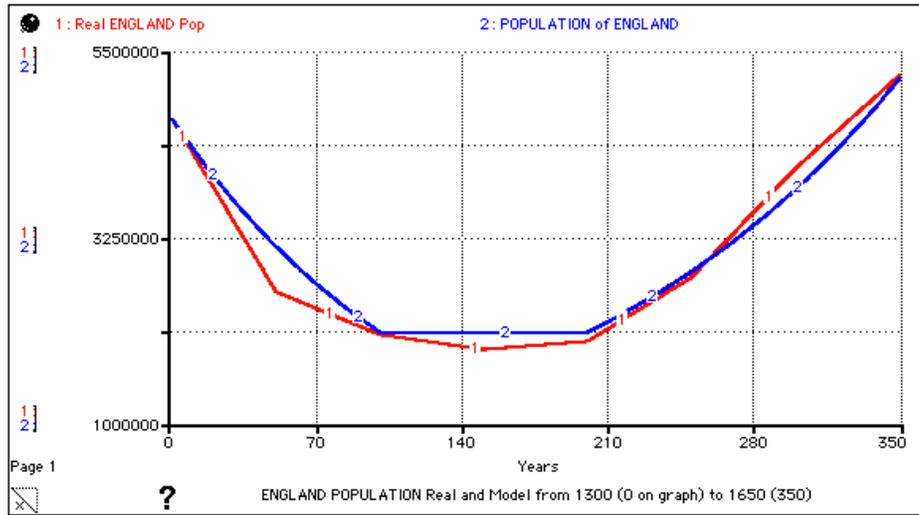
U ? 29

England births per thousand

? 35

Run Reset

Actual English Population: 5,228,000  
 Model Projected: 5,186,645



- A. What did you notice and learn by working to match your graph to the real historical population of England?
- B. What happened to the death rates in your simulation?
- C. Look back at the events happening during this period. How might they have been connected to the three different death rates? NOTE: you'll need to infer beyond the event itself to think about the impact that event had on society over time.
- D. How does your conclusion in STEP 2 compare to your original theory in STEP 1 above?

### **STEP 3. Connect Changing Population Dynamics to Changes in the Environment and Social Systems**

Go on to Page 4 in the Sim and review all of the materials that describe what was happening with England's environment. How does the environment influence English population demographics? How does it work the other way, too, such that the population demographics impact England's environment? Describe below.

Review Page 5 in the Sim, focusing on England's economy. How did England's population dynamics impact its economy? And how did the economy in turn affect the population? Describe below.

#### **STEP 4. What Did the “Players” Give as Reasons For Settling?**

Go to the Page 6 in the Sim and read the three primary source excerpts from Richard Hakluyt and John Winthrop. What evidence supports a hypothesis that the Puritans were pushed out of England? What evidence supports the position they were pulled to New England? Record each below.

Pushed Out of England

Pulled to New England

#### **STEP 5. Were English Puritans Pushed or Pulled to New England?**

Now it's time to put all of the pieces together. In the course of this simulation, you have been introduced to (a) a changing English population (1300-1650) based on a changing death rate, (b) disease outbreaks, (c) urbanization (a changing environment), (d) poverty/crime, (e) changing wages, prices and jobs (a changing economy), and (f) religious zeal. Incorporate all of these into a story that explains in what ways the Puritans were pushed out of England or pulled to New England or both.

**Teacher Guide – Part A, #3**  
**What Population Challenges Do Modern Nations Face?**

*This handout will guide you through a problem-solving exercise that examines how present day “birth rates” and “death rates” may shape the future.*

<http://clexchange.org/curriculum/complexsystems/populationdynamics/popdynA.asp>

**NOTE:** If students did not work with Sim 1, please make sure they read ALL of the material in the Introduction, as it explains how demographers use birth and death rates to calculate population change. As presented and discussed in the Sim 1 handout, students should be able to define “Birth Rate” and “Death Rate” and explain the conditions that give rise to PUSH or PULL dynamics of movement into and out from select populations.

**STEP 1. How Do Different Birth and Death Rates Affect Populations?**

Open Simulation 3 and read the instructions on Page 2. Use information from the “Population Table For Selected Countries” and set initial population(s), birth and death rates for one selected country (Country A) or, for comparative purposes, two countries (add Country B) in the blue boxes. Run the simulation and record the information below. Choose another country or countries, set the data from the chart in the blue boxes, and run the simulation again.

**First Simulation**

Country A: \_\_\_\_\_

Initial Population: \_\_\_\_\_

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

**Second Simulation**

Country C: \_\_\_\_\_

Initial Population: \_\_\_\_\_

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

**First Simulation**

Country B: \_\_\_\_\_

Initial Population: \_\_\_\_\_

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

**Second Simulation**

Country D: \_\_\_\_\_

Initial Population: \_\_\_\_\_

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

## STEP 2. Assess What You've Learned

Use your data to answer these questions (printing the graphs will help):

- What does the model project will happen over the next 100 years? Describe trends that are common to more than one of the selected countries. What trends are particular to a single country?
- Describe a possible alternative (to what the model projects) below for one of the countries you've chosen.

The “Debrief” on Page 3 offers some powerful illustrations for where and how present trends may produce a very different future. For example, India may become more populous than China, or Pakistan larger than the US. Shrinking birth rates in major industrial powers, such as Japan and Germany, may lead to significantly reduced populations over time.

These patterns, though, may not continue if growth encounters limits – especially environmental and economic. Historically, such limits have triggered wars and/or migration. They have also led to changes in marriage and fertility rates, health conditions that foster increased death rates, and other demographic issues.

Obviously, none of that information is contained in this exercise. However, students should be encouraged to speculate or, better yet, to research potential environmental, economic, or other factors with which to strengthen their argument.

The goal is to challenge students to think about what the future holds. After all, the only constant in population dynamics is change over time.

NAME \_\_\_\_\_

**Student Guide – Part A, #3**

**What Population Challenges Do Modern Nations Face?**

*This handout will guide you through a problem-solving exercise that examines how present day “birth rates” and “death rates” may shape the future.*

<http://clexchange.org/curriculum/complexsystems/populationdynamics/popdynA.asp>

**STEP 1. How Do Different Birth and Death Rates Affect Populations?**

Open Simulation 3 and read the instructions on Page 2. Use information from the “Population Table For Selected Countries” and set initial population(s), birth and death rates for one selected country (Country A) or, for comparative purposes, two countries (add Country B) in the blue boxes. Run the simulation and record the information below. Choose another country or countries, set the data from the chart in the blue boxes, and run the simulation again.

**First Simulation**

Country A: \_\_\_\_\_

Initial Population: \_\_\_\_\_

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

**First Simulation**

Country B: \_\_\_\_\_

Initial Population: \_\_\_\_\_

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

**Second Simulation**

Country C: \_\_\_\_\_

Initial Population: \_\_\_\_\_

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

**Second Simulation**

Country D: \_\_\_\_\_

Initial Population: \_\_\_\_\_

Birth Rate (per 1000): \_\_\_\_\_

Death Rate (per 1000): \_\_\_\_\_

FINAL POPULATION: \_\_\_\_\_

**STEP 2. Assess What You’ve Learned**

Use your data to answer these questions (on the back of this page). Printing the graphs will help.

- What does the model project will happen over the next 100 years? Describe trends that are common to more than one of the selected countries. What trends are particular to a single country?
- Describe a possible alternative (to what the model projects) for one of the countries you’ve chosen.