Title: The Secret

Suggested Time: 4 days (45 minutes per day)

Common Core ELA Standards: RL.8.1, RL.8.2, RL.8.3, RL.8.4, RL.8.6; W.8.1, W.8.2, W.8.4, W.8.9; SL.8.1, SL.8.4, SL.8.6; L.8.1, L.8.2, L.8.5

Teacher Instructions

**Preparing for Teaching**

1. Read the Big Ideas and Key Understandings and the Synopsis. Please do **not** read this to the students. This is a description for teachers about the big ideas and key understanding that students should take away **after** completing this task.

Big Ideas and Key Understandings

The development of technological advances can be influenced by ethics or philosophy.

The truth does not always set you free.

Synopsis

“The Secret” tells the story of Henry Cooper, a reporter, returning for the second time to report on the colonies now existing on the Moon. Based on a hunch, he becomes suspicious of a “secret” that may be looming on the Moon. Cooper sets out on a mission to confirm his suspicions, which leads him to discover that life on the moon can be as long as 200 years. Cooper must then decide if this “secret” should be kept or shared with those back on Earth.

1. Read the entire selection, keeping in mind the Big Ideas and Key Understandings.
2. Re-read the text while noting the stopping points for the Text Dependent Questions and teaching Tier II/academic vocabulary.

**During Teaching**

1. Students read the entire selection independently.
2. Teacher reads the text aloud while students follow along or students take turns reading aloud to each other. Depending on the text length and student need, the teacher may choose to read the full text or a passage aloud. For a particularly complex text, the teacher may choose to reverse the order of steps 1 and 2.
3. Students and teacher re-read the text while stopping to respond to and discuss the questions, continually returning to the text. A variety of methods can be used to structure the reading and discussion (i.e., whole class discussion, think-pair-share, independent written response, group work, etc.)

Text Dependent Questions

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| **Text-dependent Questions** | **Evidence-based Answers** |
| Reread paragraphs 1-6. Where is the main character in the beginning of the story and what has happened to him? Provide specific textual evidence to support your explanation. | Henry Cooper, an UNSA journalist, is returning to the moon for the second time to write a report on his findings. His report would persuade if money should continue to be poured into space research while the problems of overcrowding demands a lot of attention also. During this visit, Cooper sense that “something was wrong somewhere, and he was going to find out what it was.” |

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| Authors use allusions to reference/connect something in their writing to something that the readers have prior knowledge about.  What do the allusions to Archimedes and Plato suggest about the population on the Moon? What evidence in the text supports this?  \*(See teacher notes) | The allusions to Archimedes and Plato suggest that the city and people in it represent great intelligence. This is evident in the name of the spaceport “Archimedes Spaceport” and the name of the city “Plato’s City”.  Both men were considered genius level. |
| Using evidence from the text, decide whether the story supports or discourages the idea of human colonies in space. | “The Secret” discourages the idea of human colonies in space because the text says, “...we need miracles of technology and engineering to merely exist…”  Although the hundred thousand of the inhabitants are not “packing all the continents to the edges--and now crowding over into the sea beds,” they are limited and jobs are not easily accessed. |
| Using evidence from the text, what does each of the following sections of the text reveal about Henry Cooper’s character?  Paragraphs 1-5  Paragraph 5 - Paragraph 5  Paragraph 6 - end) | Henry Cooper is a sensible, responsible reporter, but is suspicious of what is going on at Plato’s City.  According to the text, he sends 2000 words of copy back each day, is a hard headed science reporter,  has been requested to come back to the Moon by the UNSA, and they have trusted him for his accuracy and friendly attitude. He is suspicious because on past trips he was welcomed, but on this trip, “...the tour had gone sour…”  Henry Cooper shows determination and resourcefulness when he seeks the assistance of his friend, the Inspector General Chandra, to help him follow up on his suspicions.  He shows concernwhen he realizes Medical Research might be involved. ...here’s the only clue I have-and it frightens me.  Medical Research is trying to keep me at arm’s length.”  At first Chandra points out Cooper’s vivid imagination might be responsible for these interesting theories, but Cooper’s convincingnature and blunt approach about a possible interplanetary plague, leads to Chandra’s decision to investigate.  Henry Cooper shows insight when Inspector General Chandra calls to arrange a meeting after he investigates Cooper’s claims, “Chandra had found something.”  He demonstrates insight when he observes that, “nature guards her greatest secrets well,” as he is making the trip across the moon to the lab.  When Cooper is appraised of the discovery the scientists have made about the lab animals extended life span he further demonstrates insight when he quickly leaps to the conclusion, “My God -- you’ve found a way of prolonging life!”  Finally he shows a sense of cautiousness when questioned by Dr. Hastings about what he would tell others about what he had discovered.  “Cooper opened his mouth, then closed it again, unable to think of anything to say.” |
| Identify the secret uncovered by Cooper after meeting with Dr. Hastings.  What scientific evidence supports the secret? Use evidence from the text to support your answer. | The secret uncovered by Cooper is that Dr. Hastings has found that the span of life on the moon will be at least two hundred years.  Dr. Hastings explains the prolonging of life based on gravity.  He explains to Cooper that gravity on Earth wears down the muscles, stomach, and heart, but on the Moon the strain of gravity is reduced to a sixth, enabling the body to perform with much less wear and tear. |
| Reread the following paragraph:  “And now we find that we can live for two hundred years.  Imagine how they’re going to react to that news!  This is your problem now, Mister Journalist; you’ve asked for it, and you’ve got it.  Tell me this, please- I’d really be interested to know- *just how are you going to break it to them?”*  1.  Identify the tone shifts in the paragraph.  Cite evidence from the text to support your answer.  2.  Explain the impact that italicizing the last line has on the reader. | The speaker’s tone in sentences one and two is foreboding, indicating that Hastings is fully aware of the impact this revelation could have on the world’s population.  Sentences three and four are daring and cynical in tone, challenging Cooper to think about how he will respond without causing worldwide chaos, now that he has insisted on knowing the secret.  The italicizing reinforces the fact that chaos will most certainly ensue if the secret is revealed.  This challenge from Hastings to Cooper is intended to leave the reader wondering or questioning what role individual ethics should play when dealing with issues that affect all mankind. |
| Explain why Hastings made the decision to share the “secret” with Cooper. | It became evident to Hastings that Cooper was going to continue to act on his suspicion that a secret was being kept, “I’ve convinced the Doctor that there’s only one way to keep you quiet – and that is to tell you everything.”  Hastings felt the only way to keep him quiet was to share the secret, thus protecting the colony from any further investigation that might put the secret in danger of being revealed.  This is evidenced, when Hastings asks Cooper how he will “break it to them.” |
| In the text it states, “He [Hastings] began to speak with such icy calm that his words sank like freezing raindrops into Cooper’s mind.”  Describe how the use of figurative language enhances the meaning of the text. | Using words such as “icy calm” and the simile “words sank like freezing raindrops,” helps the reader to understand the panic and lack of control that Dr. Hastings feels when he realizes the secret is in danger of being revealed to the world. He knows he must reveal the secret in order to keep it safe, but he is fearful of divulging the news to a reporter. In order to brace himself, he describes the secret in a cold, scientific manner, completely devoid of emotion. This is meant to be chilling to Cooper, so that he might gain insight into the severity of the situation. |
| Explain the irony in the following excerpts from text.  “He waited, and waited.  Cooper opened his mouth, then closed it again, unable to think of anything to say.”  How does the author’s use of irony help to communicate his message? | The irony of the situation is that Cooper, a longtime journalist who communicates for a living, cannot think of anything to say.  The author uses this irony, a journalist being silent, to show the severity of the matter and the impact this decision will have on everyone on Earth and the Moon. |
| How does the author use facts to make his science-fiction story believable? | The author discusses some real issues that face the world today: overpopulation, lack of resources, limited funding for space research, and the need to understand and discover life in outer-space. The author also proposes realistic scientific research with the use of hamsters in experiments to explore human potentials. The explanation of the research finding is also sensible and is based on factual information. |
| Read the following thematic statement:  *Ethical and moral considerations can impact our decisions.*  How is this theme developed over the course of the text? Use evidence from the text, including references to characters, setting, and plot. | The theme begins with a suspicious Cooper, acting on his ethics as a journalist, making the decisions to follow his belief that something on the Moon is being hidden from him.  “Yet the tour had gone sour; he did not know why, but he was going to find out.”  As the story unfolds, a second person, the Inspector General Chandra, is faced with an ethical decision when Cooper confides in him that he is fearful of an interplanetary plague. “I’ll start investigating, I don’t like it either, …”  We see the ultimate ethical and moral dilemma when the secret is finally revealed to Cooper.  Dr. Hastings, who has already made his own decision, challenges Cooper, “Tell me this, please-I’d really be interested to know-just how are you going to break it to them?” |

Tier II/Academic Vocabulary

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|  | **These words require less time to learn**  (They are concrete or describe an object/event/  process/characteristic that is familiar to students) | **These words require more time to learn**  (They are abstract, have multiple meanings, are a part  of a word family, or are likely to appear again in future texts) |
| **Meaning can be learned from context** | lunar  circuit  receding  prickly  competent  microbes  hemisphere  scarcely  radial  formalities  rustlings  prolonging  heedless  implications | lunar  circuit  receding  prickly  competent  microbes  hemisphere  scarcely  radial  formalities  rustlings  prolonging  heedless  implications |
| **Meaning needs to be provided** | public relations  interplanetary  fraud  conspiracies  plague  pumice  infernal  flora  fauna | hunch  copy  arm’s length  frankly |

Culminating Writing Task

* *Write and present a two to three minute speech discussing whether or not you believe the truth of the secret should be revealed to those back on Earth. Use evidence from the text to support your position.*
* Teacher Instructions

1. Students identify their writing task from the prompt provided.
2. Students complete an evidence chart as a pre-writing activity. Teachers should guide students in gathering and using any relevant notes they compiled while reading and answering the text-dependent questions earlier. Some students will need a good deal of help gathering this evidence, especially when this process is new and/or the text is challenging!

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| ***Evidence***  ***Quote or paraphrase*** | ***Elaboration / explanation of how this evidence supports ideas or argument*** |
| “On Earth,” he said, “we spend our whole lives fighting gravity. It wears down our muscles, pulls our stomachs out of shape. In seventy years, how many tons of blood does the heart lift through how many miles? And all that work, all that strain is reduced to a sixth here on the Moon.” | The quote supports the idea that the secret should be revealed because of the health implications of life on Earth are reduced on the Moon. It is better for our bodies and people should know there is a healthier place for them. |
| “Six billion of them, packing all the continents to the edges – and now crowding over into the sea beds.” | The quote supports the idea that the secret should be revealed because of the overcrowding on Earth. There are six billion people packed on to land that isn’t big enough to hold them all. |
| “…when an overcrowded work was screaming for more roads and schools and sea farms, and complaining about the billions being poured into space.” | This quote supports the idea that the secret should be revealed. Earth is already overcrowded and seemingly without enough resources to comfortably provide for everyone. |
| “But a world where we need miracles of technology and engineering merely to exist, where a man with an IQ of only a hundred and fifty can’t even get a job.” | The quote supports the idea that the secret should not be revealed. There is already a struggle to survive on the Moon with the amount of people who currently reside there and are dependent on the technologies to keep them alive. If the secret were revealed the population would boom beyond their capacity. |

1. Once students have completed the evidence chart, they should look back at the writing prompt in order to remind themselves what kind of response they are writing (i.e. expository, analytical, argumentative) and think about the evidence they found. (Depending on the grade level, teachers may want to review students’ evidence charts in some way to ensure accuracy.) From here, students should develop a specific thesis statement. This could be done independently, with a partner, small group, or the entire class. Consider directing students to the following sites to learn more about thesis statements: http://owl.english.purdue.edu/owl/resource/545/01/ OR http://www.indiana.edu/~wts/pamphlets/ thesis\_statement.shtml.
2. Students compose a rough draft. With regard to grade level and student ability, teachers should decide how much scaffolding they will provide during this process (i.e. modeling, showing example pieces, sharing work as students go).
3. Students complete final draft.
4. Students rehearse and then present their speech to the class.

* Sample Answer

Have you ever been told a secret so important that you weren’t sure if you should keep it to yourself or not?  This secret is so explosive that if everyone learned of it, it could have far reaching consequences.  That is why Henry Cooper should not reveal the secret he discovers, that living on the moon extends a person’s life span to at least two hundred years of age, to the rest of the world.

Revealing the secret would be a mistake.  To do so, “...when an overcrowded world was screaming for more roads and schools and sea farms, and complaining about the billions being poured into space,” would likely begin a conflict between Earth and the Moon.  The people on Earth are already complaining about all the money that is paid to support the Moon colony when so much is needed on Earth.  The Moon colony is also limited in its ability to support a larger population and lacks the capacity to grow in a manner that can really affect the Earth’s overcrowding problems. The Moon is too dependent on the Earth’s monetary resources and generosity to risk the conflict that would be inevitable if people were to find out the secret.  If the secret is revealed the Earth could hold resources hostage in a bid to bend the Moon to its will.

Another reason that revealing the secret would be a mistake is because of the Moon’s dependence on Earth’s resources.  “But a world where we need miracles of technology and engineering to merely exist, where a man with an IQ of only a hundred and fifty can’t even get a job”.  There is already a struggle to survive on the Moon with the relatively small population that currently resides there and they are dependent on technology to keep them alive.  If the secret were revealed the population would boom beyond the Moon’s capacity.

Some may argue that the secret should be revealed.  ‘“On Earth,” he said, “we spend our whole lives fighting gravity.  It wears down our muscles, pulls our stomachs out of shape.  In seventy years, how many tons of blood does the heart lift through how many miles?  And all that work, all that strain is reduced to a sixth here on the Moon.”’ People should be told about the health benefits of living on the Moon so that they can make an informed decision about their own health.  However, it can also be argued that the Moon cannot support the billions that populate Earth, so why raise the hopes of so many when so few can actually reap the rewards?

These are some of the reasons why Henry Cooper should not reveal the secret to the rest of the world.  Sometimes it is better to protect the people from knowledge for the greater good of society.  Should he reveal the secret very few would benefit, but many would have undoubtedly been hurt.

Additional Tasks

* Read the two scientific articles about the population boom (see below). The first discusses the population boom in the United States and second discusses the population boom in the world. Using evidence from both pieces, write an expository essay discussing the causes of the population increase and the effects if the increase continues.
  + *Rapid US Population Growth - Food and the Environment* By David Pimentel
  + [*Human Population Growth Creeps Back Up*](http://www.scientificamerican.com/article.cfm?id=human-population-growth-creeps-back-up&print=true) By [Colin Sullivan](http://www.scientificamerican.com/author.cfm?id=1939) and [ClimateWire](http://www.scientificamerican.com/author.cfm?id=2308)

Additional Teacher Instructions for Additional Task:

1. Students identify their writing task from the prompt provided.
2. Students complete an evidence chart as a pre-writing activity.

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| ***Evidence***  ***Quote or paraphrase*** | ***Elaboration / explanation of how this evidence supports ideas or argument*** |
| “The U.S. population has doubled in the past six decades to over 300 million people…In about 100 years, at our current growth rate, the U.S. population is projected to reach 1.2 billion.” (Pimentel) | This quote emphasizes how the population in the United States is growing at a rapid rate. |
| “Earth’s human population is expected to coast upward to 9.6 billion by 2050 and 10.9 billion by 2100, up from the 7.2 billion people alive today.” (Sullivan) | This quote emphasizes how the population in the world is growing at a rapid rate. |
| “…our natural resources, from land to wood to oil to water, are finite and cannot sustain an infinite population growth without seriously impacting our quality of life.” (Pimentel) | This quote supports the effects the population boom will have on the United States if it continues to grow. |
| “Most U.S. cropland is now in production and little is available for expanding food production.” (Pimentel) | This quote emphasizes the effects of the population boom is having on the land and resources. They are dwindling, because the U.S. is literally running out of room to expand for the necessary resource of food. |
| “The continued expansion of the human population not only is depleting fossil fuels, it is reducing the numbers of native species of plants, animals, and microbes throughout the U.S.” (Pimentel) | This quote emphasizes the effect of the boom on the environment. |
| “Rapid, unabated population growth, including legal and illegal immigrants, also is stressing school systems.” (Pimentel) | This quote supports a cause of the population boom in the U.S. with the increase in both legal and illegal immigrants. The quote also supports the effect of the boom on the school systems, as it goes on to discuss the number of students versus the number of staff and schools able to support the students. |
| “Most of this growth will take place in less-developed, lower income nations….in countries like Nigeria, Uganda…the women are still averaging more than 5 children per family, while many high-income nations in Western Europe and elsewhere are having fewer than 2 children per woman.” (Sullivan) | This quote explains a reason for why the population is continuing to grow in different parts of the world. |
| “Another factor affecting the whole picture is age expectancy…life expectancy worldwide from 2005 to 2010 was 69 years, but that number will climb to an average of 76 years by 2050 and 82 years by 2100.” (Sullivan) | This quote explains another reason for why the population will continue to grow as life expectancy increases. There will be people on Earth for much longer. |
| “Immigration is expected to help keep the United States stocked with young people. DESA (Department of Economic and Social Affairs) anticipates continued immigration to the United States at about the same level as today out to 2050 and 2100.” (Sullivan) | This quote explains another reason the United States population will continue to increase in the coming years as more people continue to immigrate to the U.S. |
| “Similarly, the rapid increase in the population is crowding medical facilities…in the past two decades the number of outpatients has increased more than two fold.” (Pimentel) | This quote provides another effect of the population boom. This example shows the effect on the health care system. |
| “We, as a nation, must come to grips with the harsh reality that our land, energy, food and water are finite. The quality of life for us, and especially for our children and future generations, is closely linked to the number of people who live in our 50 states.” (Pimentel) | This quote sums up the effects the population boom is having on the U.S. The quote can also be used to relate to the boom globally as well. |

1. Once students have completed the evidence chart, they should look back at the writing prompt in order to remind themselves what kind of response they are writing (i.e. expository, analytical, argumentative) and think about the evidence they found. (Depending on the grade level, teachers may want to review students’ evidence charts in some way to ensure accuracy.) From here, students should develop a specific thesis statement. This could be done independently, with a partner, small group, or the entire class. Consider directing students to the following sites to learn more about thesis statements: http://owl.english.purdue.edu/owl/resource/545/01/ OR http://www.indiana.edu/~wts/pamphlets/ thesis\_statement.shtml.
2. Students compose a rough draft. With regard to grade level and student ability, teachers should decide how much scaffolding they will provide during this process (i.e. modeling, showing example pieces, sharing work as students go).
3. Students complete final draft.

* Sample answer

In the story “The Secret,” by Arthur C. Clarke, a reporter stumbles upon a secret on the Moon that would increase life expectancy to at least 200 years. The concern, with the Earth’s population already booming, how could it possibly sustain this additional increase if the secret were revealed? Although this story is fictional, the rapid population boom in the world and the effects it is already having on the United States and globally is a reality.

The population in the world and especially in the United States is continuing to grow at a rapid rate. According to Pimentel, “The U.S. population has doubled in the past six decades to over 300 million people…In about 100 years, at our current growth rate, the U.S. population is projected to reach 1.2 billion (page 1).” The population continues to grow worldwide. Sullivan states, “Earth’s human population is expected to coast upward to 9.6 billion by 2050 and 10.9 billion by 2100, up from the 7.2 billion people alive today (page 1).” The reasons behind the increase in population in the United States and the world can be attributed to the various reasons. One reason the world population continues to increase, especially in lower economic regions and countries, is the birth rate. According to Sullivan, “ Most of this growth will take place in less-developed, lower income nations….in countries like Nigeria, Uganda…the women are still averaging more than 5 children per family, while many high-income nations in Western Europe and elsewhere are having fewer than 2 children per woman (page 1).” In the United States, the increase in population can be linked to the increase in immigration. “Immigration is expected to help keep the United States stocked with young people. DESA (Department of Economic and Social Affairs) anticipates continued immigration to the United States at about the same level as today out to 2050 and 2100(Sullivan, page 2).” Additionally, Pimentel states, the “Rapid, unabated population growth, including legal and illegal immigrants, also is stressing school systems (page 2).” The stress of the growth on the school systems in the U.S. is just one of the many effects of the population boom in not only the U.S., but the world. Finally, the population in the world and the U.S. continues to increase, because people are living longer. “Another factor affecting the whole picture is age expectancy…life expectancy worldwide from 2005 to 2010 was 69 years, but that number will climb to an average of 76 years by 2050 and 82 years by 2100(Sullivan, page 2).”

The impact of the population boom on the U.S. and the world could eventually cause the way we live now to change drastically as our environment, resources, and ways of living are impacted, “…our natural resources, from land to wood to oil to water, are finite and cannot sustain an infinite population growth without seriously impacting our quality of life(Pimentel, page 1).” In the U.S., “Most U.S. cropland is now in production and little is available for expanding food production(Pimentel, page 1).” The effects of the population boom on the land and resources means they are dwindling. The U.S. is literally running out of room to expand for the necessary resource of food. Additionally, the impact on the environment is also a concern. According to Pimentel, “The continued expansion of the human population not only is depleting fossil fuels, it is reducing the numbers of native species of plants, animals, and microbes (page 1).” The population boom is also affecting education and health care. Pimentel discusses the overcrowding of schools and the demand for staff as previously stated. However, Pimentel goes on to discuss the impact the population has on the health care system, “the rapid increase in the population is crowding medical facilities…in the past two decades the number of outpatients has increased more than two fold (page 2)”

Globally, the population continues to increase and the effect of the boom is impacting the world physically, environmentally, and as a socially. Pimentel sums up the potential crisis in the U.S. faces by saying, “We, as a nation, must come to grips with the harsh reality that our land, energy, food and water are finite. The quality of life for us, and especially for our children and future generations, is closely linked to the number of people who live in our 50 states (page2).” Although Pimentel is referring to the U.S. specifically, the concerns of one nation affect all nations.

Note to Teacher

* Students will need a brief description of Archimedes and Plato in order to address the text dependent question on allusion.

**[](http://www.scientificamerican.com/)**

[](http://www.flickr.com/photos/jamescridland/613445810/)Permanent Address: <http://www.scientificamerican.com/article.cfm?id=human-population-growth-creeps-back-up>

[**Human Population Growth Creeps Back Up**](http://www.scientificamerican.com/article.cfm?id=human-population-growth-creeps-back-up&print=true)

New U.N. estimates suggest 9.6 billion people by 2050

By [Colin Sullivan](http://www.scientificamerican.com/author.cfm?id=1939) and [ClimateWire](http://www.scientificamerican.com/author.cfm?id=2308)  | Friday, June 14, 2013 | [24](http://www.scientificamerican.com/article.cfm?id=human-population-growth-creeps-back-up&print=true#comments)

Large crowd in Paris, France. Image: Flickr/James Cridland

UNITED NATIONS -- Earth's human population is expected to coast upward to 9.6 billion by 2050 and 10.9 billion by 2100, up from 7.2 billion people alive today, a United Nations agency has projected.

The U.N. Department of Economic and Social Affairs yesterday released revised numbers for the coming century, raising median estimates for population growth in 2050 and 2100. The agency's prior best guess had humanity at 9.3 billion in 2050 and 10.1 billion in 2100.

Most of this growth will take place in less-developed, lower-income nations, mostly in sub-Saharan Africa. John Wilmoth, director of the population division at DESA, explained that the revisions reflect adjustments to how high-fertility countries are behaving.

In countries like Nigeria, Uganda, the Democratic Republic of the Congo and Afghanistan, women are still averaging more than 5 children per family, while many high-income nations in Western Europe and elsewhere are having fewer than 2 children per woman.

Developing regions are today home to about 5.9 billion, but that number is expected to soar to 8.2 billion in 2050. Population in developed nations will stay about the same, at 1.3 billion.

Wilmoth stressed that such projections are tricky when researchers start looking past the next few decades. DESA came up with the 10.9 billion figure as a median between extreme estimates of 6.8 billion people alive in 2100 to as many as 16.6 billion.

"We really don't know what these trends will be after a period of several decades," he said during a U.N. press conference on the population survey, explaining that the estimates reflect a best guess based on the future resembling the past.

Much of the uncertainty has to do with births and whether citizens of lower-income nations will start to change their ways and have fewer children if and when the standard of living in those countries improves. Wilmoth noted that fertility rates in India and Indonesia, to cite two instances, have recently dropped, because governments there have aggressively pursued family planning policies to rein in big families.

**Efforts needed to avoid two extremes**  
Wilmoth said low fertility could be viewed as just as difficult a challenge as high birth rates because governments have to deal with rapidly aging populations and fewer children to replace them. He cited Japan as one nation currently coping with this threat.

"The main story is to avoid the extremes of either rapid growth due to high fertility or rapid decline due to low fertility," he said.

Wilmoth also appeared to argue that humanity would adapt to either reality. He said the world population doubled from 1960 to 2000, and the pace of food production more than doubled in the same period, so he expects Earth to adjust unless the planet hits either extreme.

As for the United States, DESA considers fertility here to be on the low end, but just barely. U.S. families are averaging about 2 children per woman, which is just under the 2.1 children per woman needed to replace aging adults, Wilmoth said.

Immigration is expected to help keep the United States stocked with young people. DESA anticipates continued immigration to the United States at about the same level as today out to 2050 and 2100.

Another trend noted by the report is the emergence of more large countries. India and China will be the most populated throughout the century, with India expected to surpass China around 2028, when both will be home to about 1.45 billion. And Nigeria is expected to pass the United States by midcentury and could contest China and India as the most crowded country on the planet by 2100.

In Europe, meanwhile, fertility is below the level required to replace its population, but DESA did see an increase ahead, from 1.5 children per woman in 2010 to 1.8 by 2050 and 1.9 by 2100.

Another factor affecting the whole picture is age expectancy. DESA said life expectancy worldwide from 2005 to 2010 was 69 years, but that number will climb to an average of 76 years by 2050 and 82 years by 2100.

"By the end of the century, people in developed countries could live on average around 89 years, compared to about 81 years in developing regions," the report said.

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**Rapid US Population Growth - Food and the Environment**

**By David Pimentel**

The U.S. population has doubled in the past six decades to over 300 million people. Currently, the U.S. population growth rate is now more than twice that of China. In about 100 years, at our current growth rate, the U.S. population is projected to reach 1.2 billion -- or nearly the population of China. Is this what we want for future America?

Like it or not, our natural resources, from land to wood to oil to water, are finite and cannot sustain an infinite population growth without seriously impacting our quality of life. The time has come for government planners and citizens alike to begin weighing the impacts of unabated population growth.

More than 99% of all our food comes from the land and less than 1% from the oceans and other aquatic ecosystems. Each American consumes more than 2,200 lbs of food per year, and to produce this food requires more than 3.6 acres of agricultural land. Most U.S. cropland is now in production and little is available for expanding food production. Moreover, approximately 1 additional acre is required per person for urbanization, highways, and for supporting industry. Along with land, an ample supply of freshwater is essential for food and other human needs. Water shortages already exist in many parts of the nation, especially in western and southern states - and such shortages will become more acute if population growth continues unabated. Each American uses about 530,000 gallons of water per year, with about 80% used just for food production. For example, an acre of corn requires 500,000 gallons of water during the growing season.

More than 90% of U.S. oil reserves have already been pumped, and currently more than 63% of U.S. oil has to be imported from other nations at a cost of more than $120 billion/year. Yearly, each American uses energy in the equivalent to 2,800 gallons of oil, with 500 gallons devoted just for food production.

Fossil energy is a non-renewable resource, which means that Americans will require renewable energy sources in the future. Depending on the geographic region, the renewable energy technologies with the greatest potential are photovoltaics, hydropower, wind energy, biomass (thermal), solar thermal, and passive solar. Yet, even when all solar-based technologies become operational, they are expected to provide only half of the current U.S. energy consumption. These renewable energy technologies will require about 17% of U.S. land area for their production -- and this is equal to current cropland area in use. The U.S. is now producing 5 billion gallons of ethanol per year. This uses 20% of the U.S. corn crop but the yield represents only 1% of U.S. petroleum use. If 100% of U.S. corn were used, the estimated ethanol yield would provide only about 6% of U.S. petroleum needs.

The continued expansion of the human population not only is depleting fossil fuels, it is reducing the numbers of native species of plants, animals, and microbes throughout the U.S., many of which are vital to agricultural production processes, such as pollination, and essential for a quality environment. Converting land to development and highways not only takes away valuable cropland acreage. For example, in California 240,000 acres of farmland was lost during last year to development.

Highway construction also destroys many thousands of acres of natural habitat for survival of native species. Nearly 4 million miles of highways cover our land. The area being blacktopped each year is 1.3 million acres (an area equal to the State of Delaware). No species lives under the blacktop. Rapid, unabated population growth, including legal and illegal immigrants, also is stressing school systems. Some schools have three times the number of students that they can handle with the available teachers and support staff. Overall this lowers our effectiveness of the education system, which in turn reduces the economic viability and competitiveness of the United States in the global market.

Similarly, the rapid increase in the population is crowding medical facilities in the United States. In the past two decades the number of outpatients in hospitals has increased more than two fold, and continues to increase. Some hospitals have been forced to close due to the pressure on their emergency and outpatient facilities. The rapid population increase in the United States is challenging our food production system, the economy in general, and the environment. As humans and their diverse activities expand, the sustainability of the natural environment is threatened and diminished for the future.

We, as a nation, must come to grips with the harsh reality that our land, energy, food and water are finite. The quality of life for us, and especially for our children and future generations, is closely linked to the number of people who live in our 50 states.

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