



Mathematical Concepts in Natural Resource Stewardship

Middle School Food and Agricultural Literacy Curriculum

Precepts

- J. Mental Growth
- J4. Solve problems

National Standards

- ESS.04.02.06.c. Survey and evaluate local recycling programs and procedures.
- CS.02.04.02.a. Explore tools used in creative problem-solving.
- NL-ENG.K-12.12 – Applying Language Skills
- NM-NUM.3-5.1 – Understand Numbers, Ways of Representing Numbers, Relationships among Numbers, and Number Systems
- NM-NUM.3-5.3 – Compute Fluently and Make Reasonable Estimates
- NS.5-8.6 – Science in Personal and Social Perspectives
- NSS-C.5-8.5 – Roles of the Citizen

Student Learning Objectives

- As a result of this **unit** the students will...
- Identify best practices to be utilized in Natural Resources Stewardship.
- As a result of this **lesson** the students will ...
- Apply math concepts related to Natural Resource Stewardship.

Content Outline

Objective 1. Apply math concepts related to Natural Resource **Stewardship**.

I. Natural Resource Stewardship Mathematical Problem

- A. A baby is born. Over the next 2.5 years, this baby will use an average of 3.5 disposable diapers a day. How many diapers will be placed in a landfill from this one child? If a total of 4 million American babies were born in the same year, how many diapers were placed in landfills from all children in the U.S. over the two and one-half year span?

Time

Instruction time for this lesson: 45 minutes.

Resources

National FFA Organization. (2009). LifeKnowledge Online. Retrieved July 17, 2009, from <http://agedlearning.org>. — National FFA Organization. (2003). LifeKnowledge Precepts and Signs of Success.

Tools, Equipment, and Supplies

Writing surface
MS.NR.7.5.AS.A – five copies, also serves as assessment for class
MS.NR.7.5.AS.B – five copies (cut each problem into an individual strip)
MS.NR.7.5.AS.C – five copies
Transparencies and projector or LCD projector
MS.NR.7.5.TM.A – one per teacher
MS.NR.7.5.TM.B – one per teacher
Calculators – optional

Key Terms

The following terms are presented in this lesson and appear in **bold italics**:

Stewardship

1. 3,193.75 diapers
 2. 12,775,000,000 diapers
- B. You drive an SUV that gets 10 miles per gallon gasoline usage. You live five miles from where you work and drive your SUV to and from work each day (five days a week). You also have a bicycle that is not getting much use but could easily be ridden to work instead of driving the SUV. Gasoline for the SUV costs \$2.75 per gallon. Given the above information, how much money could you save in one month (four work weeks) if you rode your bike to work every day instead of driving the SUV?
1. \$55.00
- C. While brushing your teeth, you leave the water running for two minutes. Four quarts of water are wasted during each minute that the water is running. One quart is equal to .25 gallons. If you brush your teeth once a day during the month of June, how many gallons of water are you wasting?
1. 60 gallons



Lesson Number: MS.NR.7.5

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- D. Your school started a paper recycling project – ALL paper was recycled including newspapers, old textbooks, student work that gets thrown away, magazines, and copies made by teachers. At the end of the year, 4.2 tons of teacher copies, 6.4 tons of newspapers, 2.7 tons of magazines, 3.2 tons of old textbooks and 9.1 tons of student work were recycled. For every ton of recycled paper, 17 trees are spared from being cut down. How many trees did your school spare from their recycling project? Write your answer as a whole number.

1. 435

- E. You are going through your closet doing some "spring cleaning" and decide to throw out 12 of your old t-shirts. When cut in half, each t-shirt is the size of the disposable rags that you use to wash your car. You wash your car twice a month and use one disposable rag each time. Each disposable towel costs \$1.25. If you decided to reduce the use of disposable rags by reusing your old t-shirts as wash rags, how much money would you save in seven months?

1. \$17.50

In this lesson, students will be divided into groups and moving throughout the school without your supervision. Before teaching this lesson, you will want to communicate your plans with school administration and get approval for the activity. Make sure that the administration understands students will not be under your direct supervision as they move in groups throughout the school. Or provide aids/volunteers that can supervise students as they complete the activity. Additionally, you will instruct the students to talk with a friend throughout this lesson; this can be predetermined by you. It may be easiest to have students match up with someone sitting close by.

Interest Approach

Read this scenario to the students:

A middle school student is anxiously awaiting the release of a new game. He has saved \$15.00 to purchase the game as soon as it comes out. On the day the game is released, his parents take him to the store to purchase it. The price tag reads \$14.99. When he takes the game to the counter, the man behind the register explains that the total cost is more than \$14.99 because of tax – something the young man had not considered. His parents told him that he would have to pay for the game himself if he wanted it that badly, but

now he is faced with a problem. What should he do? Answer this question with a partner and list two possible solutions to share with the class in 30 seconds.

Pause for 30 seconds while students discuss the problem.

Okay, it's time to hear how the young man could solve his problem. Who will share first?

Facilitate a discussion about different things the boy could do to solve his problem. Possible answers might be that he could ask his parents for the remainder of the money and repay them later, play the game at a friend's house, or he could wait until he has the correct amount needed and then go back. Once students have provided responses, continue.

Excellent work! There were many different suggestions provided as to how the young man could solve his problem. We are all faced with problems from time to time. Sometimes these problems are easily solved, but often they are more challenging. As demonstrated in the discussion, talking with someone else often generates multiple ways to solve a problem.

We have been discussing natural resources **stewardship** in class. Today, we are all going to solve some problems related to natural resources **stewardship**. To do this, we will work in groups and travel around the school looking for problems that need to be solved. This will require us to be respectful of other classes that are in session and communicate with one another to identify the best way to solve a problem.

Summary of Content and Teaching Strategies

Objective 1. Apply math concepts related to Natural Resource Stewardship.

In the next portion of this lesson, you will use the Go Get It e-Moment®, which allows students to get up, move, and retrieve information. Prior to teaching this activity, you will identify five staff members at your middle school who will agree to assist.



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Divide the students into five different groups. Each group will be given **MS.NR.7.5.AS.C** which contains space for solving five mathematical problems related to natural resources stewardship. Students will have to visit a staff member to get the math problem that must be solved.

After solving the problem, students will show their answer to the staff member. If it is correct, the designated staff member will sign off on the student's paper and then instruct the group where to go for the next problem. This will be coordinated by you.

You will give each staff member a copy of **MS.NR.7.5.AS.A** and five copies of the problem that will be distributed (**MS.NR.7.5.AS.B**). Each individual staff member will be associated with a specific number problem (problem #1, #2, #3, #4, or #5). Each group will start at a different location. If a group has difficulty solving a problem, they may be passed by another group. The goal, however, is to not have too many students in one location. Upon completion of the fifth problem, students will return to class for a review of the work. Some groups may not complete all of the problems, but there needs to be a designated time that all groups will return to the classroom. You will write this time at the bottom of **MS.NR.7.5.AS.C**.

This is not a competition between the groups; however, they may see it as such. The focus is on solving the problems correctly, not getting back first. When identifying five staff members to help, you should consider those people who are not involved with teaching students during that period. This is a great opportunity to get staff members other than teachers involved.

Consider office staff, cafeteria staff, custodial staff, administrative staff, etc. when asking people to help. You can use yourself as one of the five people as well. During the actual activity (moving from one problem to the next), students will be unsupervised or will be supervised by aids/volunteers you have recruited. After dividing students into groups continue.

Now that groups have been assigned, designate one member to be the official writer of the group. As this happens, each group will receive an activity sheet that will be used in the problem-solving activity.

Pause for 30 seconds as each group designates a writer. During this time, provide each group with one copy of **MS.NR.7.5.AS.C**. Each sheet should have the group number circled at the top (1, 2, 3, 4, or 5).

Now that each group has designated a writer, the names of every group member should be

written at the top of the sheet where it reads "list all group members below." This step can be skipped if you write the group members' names on the paper ahead of time.

Pause for 30 seconds.

Thank you, writers, for taking care of that. Would someone please read the directions at the top of this (hold up activity sheet) sheet?

Allow one student to read the directions aloud and then continue.

Thank you. It is important to remember three things during this activity. First, we must be respectful of other classes that are in session – this means that we will not be disruptive with loud talking or running through the hallways. Secondly, we must all be back in the classroom by the time written at the bottom of the activity sheet, even if all five problems have not been solved. Third, it is important to remember that each problem solved is associated with a number on the activity sheet. Only one group will start with the problem number 1. For example, group 4 will start with problem number 4. This means that the first answer for group 4 will be written beside number 4 on the activity sheet. We can all be successful if we remember these three things. A lot of directions have been given and there may be some confusion. What questions are there about this activity?

Answer any questions for clarification.

Remember, this is not a race between groups. After all groups have returned, we will discuss the problems and their answers. When your group number is called, come forward to hear which staff member should be visited to obtain the problem that will be solved first.

Call each group one at a time and tell them where they need to go first. Remind each group to be respectful, not run, write the answer beside the appropriate number, and to be back in class by the designated time. During the activity, you may want to call (if you have phones in your room or mobile phones) or e-mail the individual staff members/aids/volunteers who are helping coordinate just to check in on each group. This would allow you to have an idea that each group is on task and ask if there are noticeable behavior issues with each group.



Mathematical Concepts in Natural Resource Stewardship

I. Natural Resource Stewardship Mathematical Problem

- A. A baby is born. Over the next 2.5 years, this baby will use an average of 3.5 disposable diapers a day. How many diapers will be placed in a landfill from this one child? If a total of 4 million American babies were born in the same year, how many diapers were placed in landfills from all children in the U.S. over the two and one-half year span?
1. 3,193.75 diapers
 2. 12,775,000,000 diapers
- B. You drive an SUV that gets 10 miles per gallon gasoline usage. You live five miles from where you work and drive your SUV to and from work each day (five days a week). You also have a bicycle that is not getting much use but could easily be ridden to work instead of driving the SUV. Gasoline for the SUV costs \$2.75 per gallon. Given the above information, how much money could you save in one month (four work weeks) if you rode your bike to work every day instead of driving the SUV?
1. \$55.00
- C. While brushing your teeth, you leave the water running for two minutes. Four quarts of water are wasted during each minute that the water is running. One quart is equal to .25 gallons. If you brush your teeth once a day during the month of June, how many gallons of water are you wasting?
1. 60 gallons
- D. Your school started a paper recycling project – ALL paper was recycled including newspapers, old textbooks, student work that gets thrown away, magazines, and copies made by teachers. At the end of the year, 4.2 tons of teacher copies, 6.4 tons of newspapers, 2.7 tons of magazines, 3.2 tons of old textbooks, and 9.1 tons of student work were recycled. For every ton of recycled paper, 17 trees are spared from being cut down. How many trees did your school spare from their recycling project? Write your answer as a whole number.
1. 435

- E. You are going through your closet doing some "spring cleaning" and decide to throw out 12 of your old t-shirts. When cut in half, each t-shirt is the same size as the disposable rags that you use to wash your car. You wash your car twice a month and use one disposable rag each time. Each disposable towel costs \$1.25. If you decided to reduce the use of disposable rags by reusing your old t-shirts as wash rags, how much money would you save in 7 months?

1. \$17.50

Review/Summary

Once all groups have returned, collect the activity sheets.

Wow! That was quick. It is important that we review each of the problems encountered during this activity to make sure we all understand how to correctly solve the problems.

Using a writing surface, discuss and demonstrate how to solve each problem. Project **MS.NR.7.5.TM.A** and **MS.NR.7.5.TM.B** to highlight the word problems and correct answers. Keep the transparency master covered, and uncover as you discuss each component of the problem set. After the review, continue.

Great work today. Your cooperation in this activity is appreciated. As we talk with others about environmental **stewardship**, it may sometimes be difficult to help someone understand how important conservation is to help protect our environment. For many people, seeing is believing. Using real life examples, such as those encountered in today's activity, helps explain why **stewardship** is something we should all be concerned with. Feel free to share examples such as these with family and friends in an effort to help keep our environment safe and clean.



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Application

Extended classroom activity:

Students can reflect on knowledge obtained from previous lessons, peruse through books, or search the Internet for information related to natural resources stewardship and then create their own word problem. Students can then present self-created word problems to the class and solve them together.

FFA activity:

The FFA Chapter Reporter could write an article for the school newspaper or local newspaper using the word problems in this lesson encouraging readers to solve the problems. The following week, the Reporter could submit a follow up article with the answers.

SAE activity:

If the student is a member of a social networking site, he/she can post natural resources word problems on their personal page for their "friends" to solve.

Evaluation

For the evaluation, make the appropriate number of copies of **MS.NR.7.5.AS.A** which will serve as the evaluation tool. Students will complete this evaluation in groups.

Answers to Evaluation

1. 3,193.75 diapers & 12,775,000,000 diapers
2. \$55.00
3. 60 gallons
4. 435
5. \$17.50



Directions to staff members assisting with the Natural Resource problem solving activity:

Thank you for assisting with today's activity. Groups of students will be coming to you for a math problem related to natural resource stewardship. There are five groups total. Attached to this sheet are five copies of the math problem that you will present. Each group will receive one copy. After the group solves the problem, they will show you the answer. If the answer is correct, provide your signature by the corresponding number. For example, if a group is solving problem #3, you would sign your name by problem number three. If the answer is incorrect, tell the students to try again. Please do not help students solve the problem. Upon presenting a correct answer, you will then direct the students to the next staff member.

When students present the correct answer, direct them to visit:

Next Staff Member's Name

1. **A baby is born. Over the next 2.5 years, this baby will use an average of 3.5 disposable diapers a day. How many diapers will be placed in a landfill from this one child? If a total of 4 million American babies were born in the same year, how many diapers were placed in landfills from all children in the U.S. over the two and one-half year span?**
 - $2.5 \text{ years} * 365 \text{ days/year} * 3.5 \text{ diapers/day} = 3,193.75 \text{ diapers/2.5 years}$
 - $3,193.75 \text{ diapers/2.5 years/child} * 4 \text{ million children born in one year} = 12,775,000,000 \text{ diapers}$
2. **You drive an SUV that gets 10 miles per gallon gasoline usage. You live five miles from where you work and drive your SUV to and from work each day (five days a week). You also have a bicycle that is not getting much use but could easily be ridden to work instead of driving the SUV. Gasoline for the SUV costs \$2.75 per gallon. Given the above information, how much money could you save in one month (four work weeks) if you rode your bike to work every day instead of driving the SUV?**
 - Total miles traveled = each day (10), each week (50), and in a month (200)
 - How many gallons of gas are needed to travel 200 miles? $200 / 10 = 20 \text{ gallons}$
 - How much would 20 gallons of fuel cost? $20 * 2.75 = \underline{\$55.00}$
3. **While brushing your teeth, you leave the water running for two minutes. Four quarts of water are wasted during each minute that the water is running. One quart is equal to .25 gallons. If you brush your teeth once a day during the month of June, how many gallons of water are you wasting?**
 - How many days are in the month of June? 30
 - If you brush your teeth 30 times and you leave the water running for 2 minutes each time, how long, total time, do you leave the water running? $30 * 2 = 60 \text{ minutes}$
 - If four quarts of water are wasted each minute, how many quarts are wasted in 60 minutes? $4 \text{ quarts} * 60 \text{ minutes} = 240 \text{ quarts}$
 - How many gallons are in 240 quarts? $240 \text{ quarts} * .25 \text{ gallons} = \underline{60 \text{ gallons}}$
4. **Your school started a paper recycling project – ALL paper was recycled including newspapers, old textbooks, student work that gets thrown away, magazines, and copies made by teachers. At the end of the year, 4.2 tons of teacher copies, 6.4 tons of newspapers, 2.7 tons of magazines, 3.2 tons of old textbooks and 9.1 tons of student work were recycled. For every ton of recycled paper, 17 trees are spared from being cut down. How many trees did your school spare from their recycling project? Write your answer as a whole number.**
 - How many total tons of paper were recycled? $4.2 + 6.4 + 2.7 + 3.2 + 9.1 = 25.6 \text{ tons}$
 - How many trees were spared? $25.6 \text{ tons} * 17 \text{ trees spared per ton} = 435.2 \text{ trees}$ (but you can't save .2 of a tree...so it's a whole number) **435 trees**
5. **You are going through your closet doing some “spring cleaning” and decide to throw out 12 of your old t-shirts. When cut in half, each t-shirt is the same size as the disposable rags that you use to wash your car. You wash your car twice a month and use one disposable rag each time. Each disposable towel costs \$1.25. If you decided to reduce the use of disposable rags by reusing your old t-shirts as wash rags, how much money would you save in 7 months?**
 - How many times would you wash your car in 7 months? $7 \text{ months} * 2 \text{ car washes per month} = 14 \text{ car washes}$
 - How many disposable rags would be needed to wash your car 14 times? 14 (one rag each time)
 - How much would 14 disposable rags cost? $14 \text{ rags} * \$1.25 \text{ per rag} = \underline{\$17.50}$



Group Number: 1 2 3 4 5

List all group members below:

Directions: There are five mathematical problems related to natural resource stewardship that your group will solve. These problems are located throughout the school – various staff members have agreed to provide you with the problems. Upon receiving a problem, you will calculate the answer, write it beside the corresponding number, and show it to the staff member. If the answer is correct, the staff member will provide his/her signature and tell you where to go in order to retrieve the next problem. Once you have the fifth signature, return to the classroom. If you are stuck on a problem, keep working at it. Everyone should return by the time shown below, even if you do not have all five signatures. Use the back of this sheet or additional paper for calculations.

1.

Staff Member's Signature

2.

Staff Member's Signature

3.

Staff Member's Signature

4.

Staff Member's Signature

5.

Staff Member's Signature

RETURN TO CLASS BY _____



Natural Resource Stewardship Mathematical Problem

A baby is born. Over the next 2.5 years, this baby will use an average of 3.5 disposable diapers a day. How many diapers will be placed in a landfill from this one child? If a total of 4 million American babies were born in the same year, how many diapers were placed in landfills from all children in the US over the two and one-half year span?

3,193.75 diapers

12,775,000,000 diapers

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\$55.00

While brushing your teeth, you leave the water running for two minutes. Four quarts of water are wasted during each minute that the water is running. One quart is equal to .25 gallons. If you brush your teeth once a day during the month of June, how many gallons of water are you wasting?

60 gallons



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435

You are going through your closet doing some “spring cleaning” and decide to throw out 12 of your old t-shirts. When cut in half, each t-shirt is the same size as the disposable rags that you use to wash your car. You wash your car twice a month and use one disposable rag each time. Each disposable towel costs \$1.25. If you decided to reduce the use of disposable rags by reusing your old t-shirts as wash rags, how much money would you save in 7 months?

\$17.50