Spring 2020

NORTH DAKOTA Ag Mag

A Magazine about Agriculture for North Dakota Students

soil and water conservation

This issue of the North Dakota Ag Mag focuses on soil and water conservation in North Dakota. The information and activities are geared primarily toward the state's third, fourth and fifth graders.

The Ag Mag is distributed three times per year. Subscriptions are free, but if you're not on the mailing list or if you know someone else who wants to be added, contact the North Dakota Department of Agriculture at 1-800-242-7535 or ndda@nd.gov.

This magazine is one of the N.D. Agriculture in the Classroom Council activities that helps you and other K-12 teachers integrate information and activities about North Dakota agriculture across your curriculum in science, math, language arts, social studies and other classes. It's a supplemental resource rather than a separate program.

The average U.S. household uses about 80 gallons of water per person per day.

Introduce soil and water conservation to students by asking them what conservation means. Ask them to name ways they conserve water in everyday activities, such as turning the water off when they brush their teeth. Do they help conserve soil, too? Brainstorm how water and soil are used – and conserved – in agriculture.

Idea: Have students survey their home activities to identify ways to conserve water and make posters to hang around their house reminding them to do these tasks.

Idea: Use measuring cups and pint, quart and gallon containers of water to develop related math problems.

Teacher's Guide

The Water Cycle

Earth's water is always in movement, and the water cycle, also known as the hydrologic cycle, describes the continuous movement of water on, above, and below the surface of the Earth. Since the water cycle is truly a cycle, there is no beginning or end.

Although the balance of water on Earth remains fairly constant over time, individual water molecules can come and go in a hurry. The water in the apple you ate yesterday may have fallen as rain halfway around the world last year or could have been used 100 million years ago by Mama Dinosaur to give her baby a bath.

Idea: Ask students to describe other cycles they know.

Idea: Discuss other materials that are in liquid, vapor and solid states.

Idea: Have students identify water sources around your area. Discuss where the school's water comes from and how it's treated. Do they get their home water from a city system, rural water district, well or other source?

Idea: Have students record and graph precipitation or chart monthly or annual rainfall of the past.

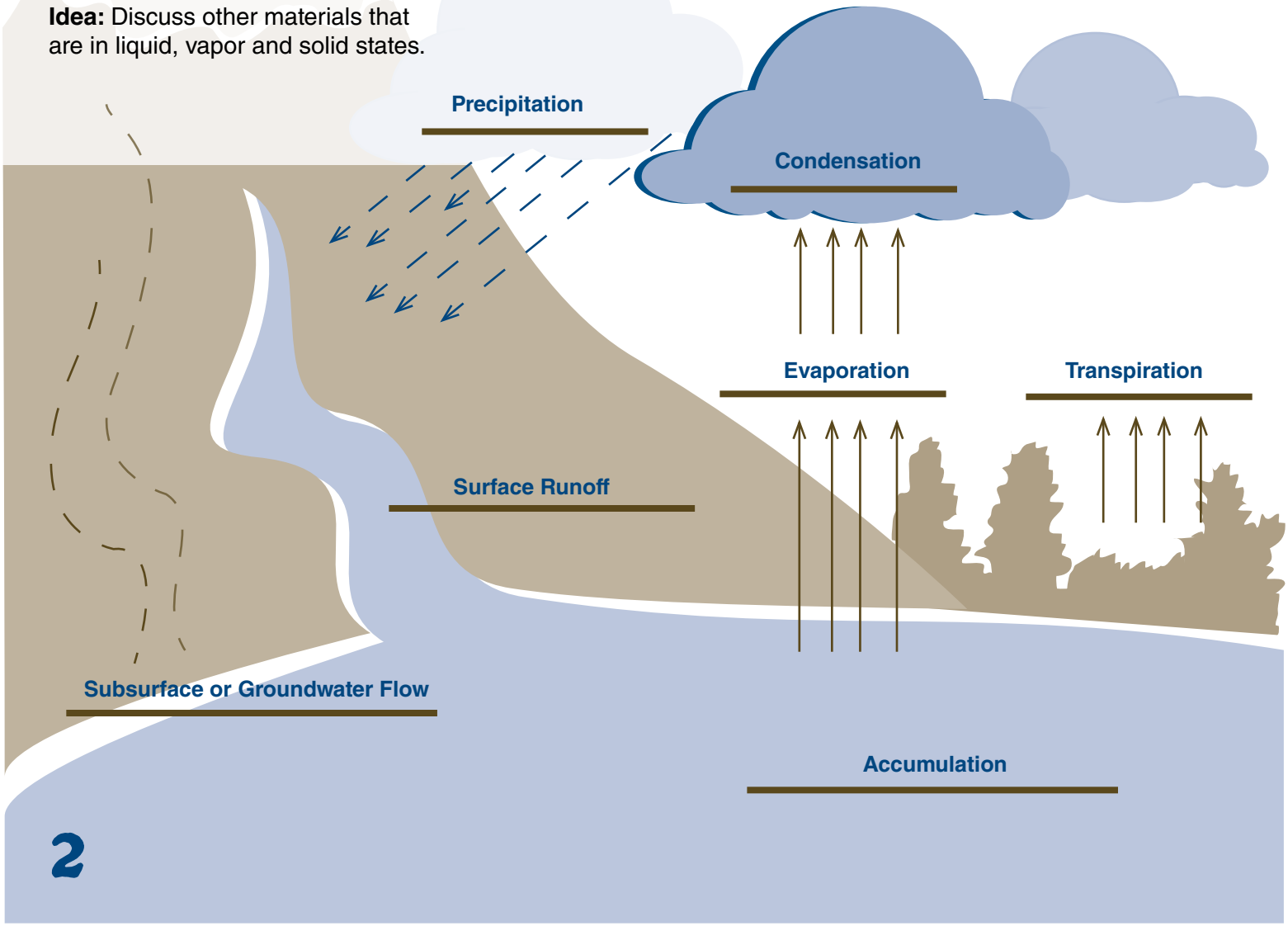
Idea: Use Project WET's Discover the Incredible Journey of Water through the Water Cycle at www.projectwet.org (search for Incredible Journey) to have students learn about the movement of water within the water cycle, the forms water takes in the three states of matter and more.

Career Corner

Idea: Visit a water treatment facility or a conservation site to learn about the jobs of the people.

Idea: Have students list and possibly research other careers that involve soil and water.

Idea: Ask someone from the local Natural Resources Conservation Service or Soil Conservation District to visit the class and talk about their career.



Sizing Up Soil

Idea: Bring in a basketball, baseball and marble to demonstrate the comparative size differences between sand, silt and clay. Show the students samples of sand, silt and clay, and mixtures of the three particles. Use different sizes of rocks to fill a clear container to demonstrate the air spaces between soil particles.

Idea: Have students compare North Dakota's soil types to those around the country. What other soils can be found? What makes the soil in North Dakota different than other places?

Idea: Use educational materials from the USDA Natural Resources Conservation Service. Go to www.nrcs.usda.gov and search for "education resources."

Idea: Have students make an edible soil. See www.ksagclassroom.org/education-center/lesson-plans/edible-soil-profile/.

Idea: Have students collect various soil samples. How are they similar? Different?

Idea: Make soil crayons, paint with soil and carry out other soil experiments at http://urbanext.illinois.edu/soil.

Soil and Water Math

1. 40 gallons/day X 7 days = 280 gallons per week,
   40 gallons/day X 365 days = 14,600 gallons per year
2. 45 gallons/day X 7 days = 315 gallons per week
3. 500 years/inch X .5 inch = 250 years
4. 3/3 — 2/3 = 1/3
5. 30 gallons/load X 8 loads = 240 gallons
6. 30 gallons X .5 = 15 gallons
7. 2 pints = 1 quart so 2 pints — 1 pint = 1 pint saved
   1 pint/brushing X 2 brushings/day
   = 2 pints saved/day
   2 pints saved/day X 7 days/week
   = 14 pints saved/week
   14 pints saved/week ÷ 2 pints/quart
   = 7 quarts saved/week
8. 4 people X 6 flushings X 1.6 gallons = 38.4 gallons
   7 — 1.6 = 5.4 gallons

Plants Need Soil

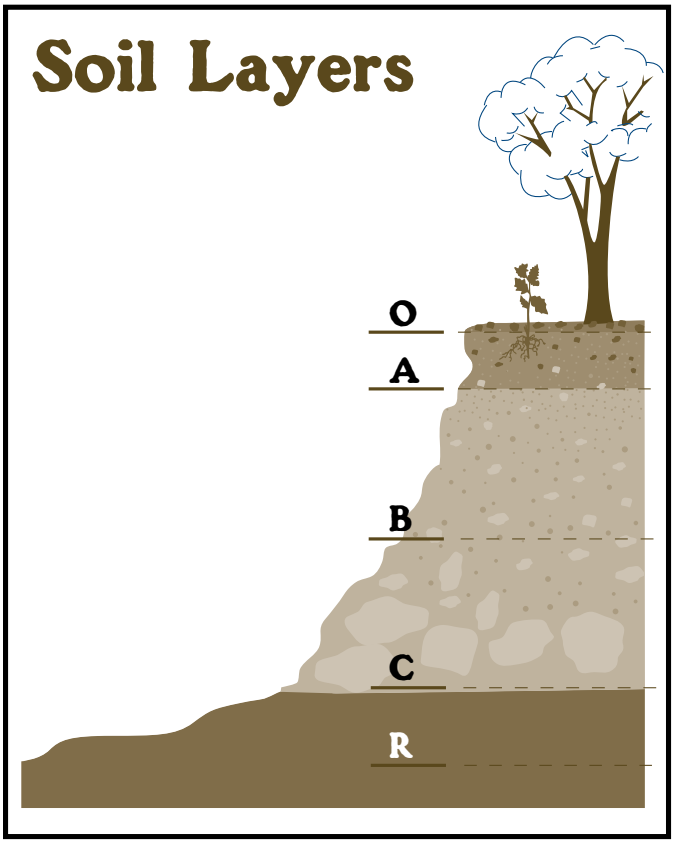
Idea: Fill a quart jar with water and add a cup of topsoil. Mix it up and watch the soil separate as the larger particles (sand) fall to the bottom first.

Idea: Drill small holes in the bottom of two small clear plastic jars. Fill each jar with a different size of beads. Place the jars in a tub and watch how the water raises the beads. This is caused by capillary action. The smallest beads (clay) will rise the most, and the largest beads will rise the least (sand). Water also can be poured into the jar to watch infiltration. The smallest beads will have the slowest infiltration rate, while the largest beads will infiltrate the fastest.

Idea: Grow soybeans in milk cartons with soil, sand only, water only and other media. Which grows the best? Why?

Idea: Demonstrate A Slice of Soil. Use this explanation to cut an apple to demonstrate the importance of conserving the Earth's soil. Develop math problems to illustrate the results.

- If the apple represents the Earth and you cut the apple into quarters, oceans make up 3/4 of the Earth.
- The remaining quarter of the Earth represents the Earth's land mass.
- One-eighth of the land represents unfarmable land, such as deserts, swamps, the Antarctic and arctic, and mountains.
- The remaining eighth represents where the people live.
- If you slice this 1/8 piece into four pieces, three of these are the areas with cities or areas where soils are not adequate for growing food, or the climate is too dry or too wet.
- Peel the last piece (3 percent of the earth). This represents the soil we have to grow our food!



The Dirty ‘30s to Today Answers

D. Vegetative wind barriers – strips of perennial or annual grass planted to hold soil in the ground.

C. Living snow fences – a line of short trees, shrubs, crops and/or native grasses primarily along roads that trap snow as it blows across fields, piling it up before it reaches the road.

A. Reduced tillage farming – any farming method that keeps tillage operations to a minimum and leaves at least 30% of the soil surface covered with plant residue after planting to reduce soil erosion by water or wind. (Conservation tillage also reduces energy use and conserves soil moisture while still maintaining crop yield and crop quality. Other benefits include improved wildlife habitat, reduced labor costs and time savings.)

B. Windbreak or shelterbelt – rows of trees that protects a farmer’s homestead or reduces wind erosion in farm fields.

The Dirty ‘30s to Today

Erosion is an easy idea to visualize. If you take a rock out of a hill then throw it down on the ground, you are eroding that hill. You have taken a big object (a hill) and started to make little objects out of it (a rock). When that rock hit the ground, it could have cracked and made some tiny pieces of rock (sand). Erosion is just that easy. When it rains, the same process happens. Rocks are washed down a hill or down a stream. Soils are washed away. The ocean beats against a cliff and breaks it apart. They are all examples of erosion.

Dust Bowl

The drought’s direct effect is most often remembered as agricultural. Many crops were damaged by deficient rainfall, high temperatures, and high winds, as well as insect infestations and dust storms. The resulting agricultural depression contributed to the Great Depression’s bank closures, business losses, increased unemployment, and other physical and emotional hardships. Although records focus on other problems, the lack of precipitation also affected wildlife and plant life, and created household water shortages.

Idea: Learn more about Dust Bowl Days on the National Endowment for the Humanities EdSiteMent Web site at http://edsitement.neh.gov/ and search for Dust Bowl Days.

Idea: Ask a grandparent or older person what life was like during the Dust Bowl.

Water Erosion

Water washes away topsoil when it’s not managed properly.

Idea: Fill a long tub or child’s swimming pool partially with soil, and prop one end up so the soil is at an angle. Use a watering can to demonstrate how the uncovered soil erodes under a light rain. Pour a bucket of water at the top to demonstrate how the soil erodes with a heavy downpour. Have the students build soil conservation strategies in the soil: plant grass, build terraces, put in dams, etc., then see how the light and heavy “rains” affect the soil.

For a smaller demonstration, use a metal or aluminum foil cake pan with a cup of water or spray bottle. Put a little bit of Kool-Aid-like beverage under the soil somewhere to show how pollution moves through the groundwater into the surface water.

Idea: Have students create a time line and label the following significant events and other events that were happening in the U.S. and the world at that time.

Early 1920s – Farmers saw several opportunities for increasing their production. New technology and crop varieties were reducing the time and costs-per-acre of farming, which provided a great incentive for agricultural expansion.

Late 1920s – Agriculture, like nearly all industries, was adversely affected by the Great Depression.

1931 – A record wheat crop sent crop prices even lower.

1933 – The Soil Erosion Service, predecessor to the Soil Conservation Service and Natural Resources Conservation Service, began working with farmers in southwestern Wisconsin.

1935 – President Franklin Roosevelt signed bills that established the Soil Conservation Service, an agency responsible for implementing practices to control soil erosion.

1937 – A bulletin by the Works Progress Administration reported that 21 percent of all rural families in the Great Plains were receiving federal emergency relief.

1941 – Most areas of the country were receiving near-normal rainfalls.

1956 – The Soil Bank was a large-scale effort to bring about adjustments between supply and demand for agricultural products by taking farmland out of production. The program was divided into two parts: an acreage reserve and a conservation reserve.

Early 1970s – Grain exports increased, especially to the Soviet Union. Farmers were encouraged to cultivate marginal lands to fill the export quotas. Those areas, amounting to almost 2 million acres, included land on slopes and wetter areas that are relatively vulnerable to erosion.

Late 1970s – The environmental movement helped return attention to the problem of soil erosion. Excessive amounts of phosphorus and nitrogen occurred in streams and lakes as a result of poor agricultural fertilization practices and inadequate soil conservation practices. In North Dakota, farmers started to adopt no-till farming practices as advances in farm machinery designs made it possible.

1985 – The Food Security Act (Farm Bill) established the Conservation Reserve Program (CRP) by removing up to 45 million acres of highly erosion-prone land from intensive cultivation and prevented the conversion of rangelands into cultivated fields. Goals of CRP are to reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. The CRP program encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filter strips, or riparian buffers.

Water Erosion Answers

B. Contour Farming – planting alternating strips of crops across the slope of the land. The strips usually alternate between a row crop like corn with a solid seeded crop like wheat, barley or alfalfa.

D. Terraces – a series of step-like contours in fields. Each “step” slows the flow of water runoff, slowing the erosion process.

A. Dam – an earthen or concrete structure to stop water flow to trap sediment, stabilize drainage ways and reduce erosion, store excess water temporarily to reduce flood damage, or store water for livestock, irrigation, household or municipal use.

C. Grassed Waterway – seeded grass in areas of a farm field that is prone to heavy water erosion or gullying.

Science Standards and Benchmarks

English Language Arts and Literacy Content Standards for Reading Informational/Nonfiction Text

Gr.3, RI.1 Ask and answer questions to demonstrate understanding of a text (textual evidence), referring explicitly to the text as the basis for the answers.

Gr.3, RI.2 Determine the main idea of a text and recount the key details to explain how they support the main idea.

Gr.3, RI.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

Gr.4, RI.1 Refer to details and examples in a text (textual evidence) when explaining what the text says explicitly and when drawing inferences from the text. Summarize the text.

Gr.4, RI.2 Determine the main idea of a text and explain how it is supported by key details.

Gr.4, RI.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

Gr.5, RI.1 Quote accurately using textual evidence when explaining what the text says explicitly and when drawing inferences from the text. Summarize the text.

Gr.5, RI.2 Determine two or more main ideas of a text and explain how they are supported by key details.

Gr.5, RI.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

Craft and Structure

Gr.3, RI.4; Gr.4, RI.; Gr.5, RI.4 Determine the meaning of general academic and domain specific words and phrases in a text relevant to a grades 3,4 and 5 topics or subject areas.

Mathematics Standards and Benchmarks:

Numbers and Operations: Fractions

3.NF.1 Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts.

Measurement and Data

Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit

4.MD.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.

Number and Operations in Base Ten

Generalize place value understanding for multi-digit whole numbers

4.NBT.5 Using strategies based on place value and the properties of operations, multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers.

5.NBT.5 Fluently multiply multi-digit whole numbers using strategies flexibly, including the standard algorithm.

Science Standards and Benchmarks:

Earth and Human Activity

3-ESS3-1: Evaluate the feasibility of a design solution that reduces the impacts of a weather-related hazard.

ESS3.B: Natural Hazards – A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

Earth and Space Science

4-ESS2-1: Make observations and metric measurements to provide evidence of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation.

ESS2.A: Earth Materials and Systems – Rainfall helps to shape the land and affects the types of living things found in a region. Water ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

Earth and Human Activity

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

ESS3.C: Human Impacts on Earth Systems – Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. However, individuals and communities are doing things to help protect Earth's resources and environments.

Social Studies Standards and Benchmarks:

K-5 History Standards: (Using Resources and Research Activities from the Teachers Guide)

Connections, Contributions, Historical Sources, and Evidence – Grades 3-5

H.3_5.7 Explain cause and effect relationships among historical events in the United States using primary and secondary sources.

North Dakota Agriculture in the Classroom Activities

Each issue of the **Ag Mag** focuses on an agricultural commodity or topic and includes fun activities, bold graphics, interesting information and challenging problems. Send feedback and suggestions for future Ag Mag issues to:

Becky Koch
NDSU Agriculture Communication
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Another council teacher resource is **Project Food, Land & People** (FLP). Using the national FLP curriculum and national Agriculture in the Classroom resources, N.D. Ag in the Classroom provides 600-level credit workshops for teachers to instruct them in integrating hands-on lessons that promote the development of critical thinking skills so students can better understand the interrelationships among the environment, agriculture and people of the world. Teachers are encouraged to adapt their lessons to include North Dakota products and resources.

Project Food, Land & People has 55 lessons, including:

- Amazing Grazing
- Cows or Condos?
- Seed Surprises
- Schoolground Caretakers
- Could It Be Something They Ate?
- What Piece of the Pie?
- and many more.

For information, contact:

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N.D. Farm Bureau Foundation
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The N.D. Geographic Alliance conducts a two-day **Agricultural Tour for Teachers**. The tour includes farm and field visits, tours of agricultural processing plants to see what happens to products following the farm production cycle, and discussions with people involved in the global marketing of North Dakota farm products.

For information, contact:

Marilyn Weiser
North Dakota Geographic Alliance
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Educators may apply for **mini-grants for up to $500** for use in programs that promote K-12 agricultural literacy. Individuals or groups such as teachers, 4-H leaders, commodity groups and others interested in teaching young people about the importance of North Dakota agriculture may apply.

The proposed project must be targeted to young people 5-18 years of age and should enhance student knowledge of the contribution made by agriculture. Applications asking for funds for equipment or curriculum as well as those that involve innovative approaches to promoting agricultural literacy will be given preference. Examples of programs that may be funded: farm safety programs, purchase of agriculture curriculum, celebration of agriculture festivals, agricultural-based books for the local library, farm safety days, startup funds for a small greenhouse project, etc. Visit www.ndaginclassroom.org for ideas that can be used to support your project. Applications are due every year in early September.

For information, contact:

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North Dakota Agriculture in the Classroom Council

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Nancy Jo Bateman – N.D. Beef Commission
Jackie Buckley – Youth Ag Education Representative
Kirk Olson – McKenzie County Farm Bureau
Nicole Wardner – NDSU Extension – Sheridan County

Statutory Member: Superintendent of Public Instruction
Kirsten Baesler (Bob Marthaller, representative)

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