

# SUMMER GRASS CAMP EDUCATIONAL CURRICULUM FOR 9TH - 12TH GRADERS

BY JUSTIN J. TRUJILLO





PAGE 1



SUMMER GRASS CAMP EDUCATIONAL CURRICULUM FOR  
9TH - 12TH GRADERS

TABLE OF CONTENTS

Background.....III

Stages.....1

Learning Plan | Monday.....5

Learning Plan | Tuesday.....9

Learning Plan | Wednesday.....15

Learning Plan | Thursday.....21

Learning Plan | Friday.....27

Additional Information.....29

References.....33



# BACKGROUND

Grasses and grass-like plants are important for ecosystem function and can also benefit humans. However, they are not easily identified. The process of learning to identify grasses and grass-like plants can be a daunting task for many people, especially in the beginning. Generally, grasses and grass-like plants are not as showy or glamorous as trees, shrubs, or wildflowers. They commonly have small, green plant parts that are very hard to see and identify. Therefore, it can be challenging for educators to select appropriate resources to help their students learn how to identify these complex species.

To help educators and students understand the importance of, and differences among, grasses and grass-like plant species, a 9th-12th grade curriculum for a 5-day summer camp was developed. To complement the 9th-12th grade curriculum, a field journal was created to help students: take notes; draw pictures of different vegetative and reproductive features; understand how to use a dichotomous key; learn how to properly identify soils by using a “Soil Texture By Feel” flowchart; and, know how to properly fill out information for a site description.

Many of the ideas for the curriculum came from the book *Understanding by Design*, by Grant Wiggins and Jay McTighe, which was crafted to help K-16 educators design curricular assessments and instructions. The curriculum also followed the Next Generation Science Standards and the Common Core State Standards Initiative. These K-12 standards were designed to develop students’ scientific literacy, as well as enhance their skills in reading, writing, and mathematics. They were also designed to help students prepare for college, careers, and life (Next Generation Science Standards, 2017; Common Core State Standards Initiative, 2017). During the process of building the curriculum for grass identification, goals were formulated; these can be found in the brief descriptions below.

## *Identification of Grasses & Grass-like Plants*

By following this educational curriculum, educators have the opportunity to teach their students to learn not only the various vegetative and reproductive parts of grasses and grass-like plants, but also the vocabulary related to these hard-to-identify species.

## *Other Field Guides & Dichotomous Keys*

As students learn the various parts and vocabulary of a grass or grass-like plant, students will be able to apply their learning experiences to understand how to read other field guides and dichotomous keys. Learning to make these connections will allow them to narrow down their findings and make confident decisions when trying to identify a grass or grass-like plant.

## *Human Impacts & Ecosystem Health*

The educational curriculum was designed not only to assist educators in helping their students identify the grasses and grass-like plants of Idaho, but also to emphasize human impacts and ecosystem health. This will allow students to explore the effects that humans can have on grass and grass-like plant communities, especially when new building divisions are constructed in or



near sensitive habitats. Additionally, the benefits of knowing the differences between a native and an introduced grass species will help students understand the type of plants that contribute to a functional and productive ecosystem.

#### *Forage Value, Wildlife Cover, Erosion Control, & Habitat*

Besides using other field guides and textbooks, students will also be able to assess if the forage value for livestock or wildlife is poor, fair, or good by gathering information from online sources. These include the USDA PLANTS Database ([www.plants.usda.gov](http://www.plants.usda.gov)), Fire Effects Information System ([www.feis-crs.org/feis/](http://www.feis-crs.org/feis/)), and Range Plants of Utah (<https://extension.usu.edu/rangeplants/>), just to name a few. Additionally, students will be able to use the aforementioned sources and others to locate information about wildlife habitat value, erosion control, and the type of habitat where the plant is usually found.

The 9th-12th grade educational curriculum also includes other goals, performance tasks, and a detailed 5-day summer camp schedule (Monday through Friday). Most of the activities are scheduled on Monday, Tuesday, and Wednesday, and are aligned with the learning cycle, which “is a research-based instructional model that focuses on ordering phases of an activity to support learning” (Beetles, 2017). This model is based on a five-phase cycle: invitation, exploration, concept invention, application, and reflection (Fig. 1).

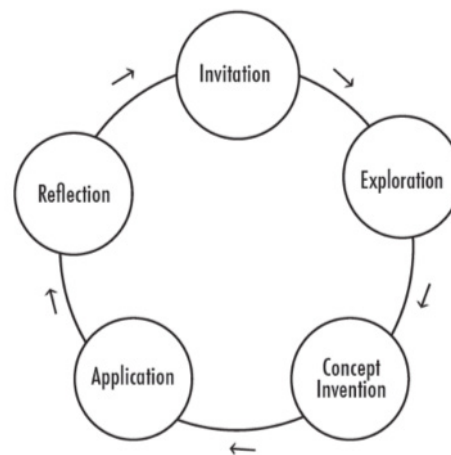


Figure 1. The different phases of the learning cycle (Beetles, 2017).

On the fourth day (Thursday) of the 5-day summer camp, the students learn to use books and online resources to gather information about what they have learned in the field. Students learn how to prepare presentations centered on a particular grass or grass-like plant that they gathered earlier in the week. Furthermore, on Friday, the students present their chosen plants, through either a PowerPoint, poster, or video presentation, before they depart from the camp.

# BACKGROUND CONTINUED

Even though the 9th-12th grade curriculum is structured on a 5-day summer camp schedule, pieces and sections of the curriculum can be extracted to fit the needs of other educators' teaching methods and time constraints. With this kind of flexibility, teachers can focus on a single lesson plan or a combination of lesson plans to help their students learn about the grasses and grass-like plants of Idaho.









# STAGES

## Stage 1 – Desired Results

### Established Goals:

#### State Standards

##### Engaging in Argument from Evidence

- Students will understand how to make and defend a claim regarding a particular grass or grass-like plant species in the natural world by showing the species to others and describing its details.
- Students will understand how to evaluate a grass or grass-like plant species and apply their findings to real-world problems based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors.

##### Obtaining, Evaluating, and Communicating Information

- Students will understand how to critically read scientific literature to help them determine central ideas or conclusions and/or obtain scientific and/or technical information about grass and grass-like plant species identification through the use of a dichotomous key and/or a published field guide containing descriptions.

##### Ecosystem Dynamics, Functioning, and Resilience

- Students will understand how to evaluate a grass or grass-like plant species in an ecosystem and verify its contribution to ecosystem resilience, especially after a biological or physical disturbance such as wildfire or invasion from invasive species.

##### Biodiversity and Humans

- Students will understand how grasses and grass-like plants contribute to biodiversity and how human activity can impact these species through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change.

#### Program Standards

- To encourage young scientists to pursue careers in the growing field of plant biology.

### Essential Questions:

- What impact will biodiversity loss have on humans and wildlife?
- Why manage for native plant species? Why manage for invasive species?
- How can government and non-government agencies work together for the protection of ecosystems and communities?
- What are some of the complex set of interactions in an ecosystem that keep it stable over long periods of time?
- What makes an ecosystem resilient to disturbances (for example, wildfire) and resistant to dominance of invasive species?

### Understandings:

*Students will understand that...*

- Making and defending a claim about a grass or grass-like plant species based on evidence from the natural world will allow them to describe in detail their own findings, with confidence, to other people.
- A dichotomous key will help identify a grass or grass-like plant species which will lead to solutions to real-world problems based on scientific ideas and principals, empirical evidence, and/or logical arguments regarding relevant factors.
- The field journal and *A Field Guide to Grasses and Grass-like Plants of Idaho* book can help converge on grass or grass-like plant identification and lend scientific and/or technical



information to help summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

- Grass and grass-like plants contribute to the function of ecosystems, and how they are essential in specific ways for long-term resilience of Idaho's shrub steppe ecosystems.
- Human impacts (e.g., overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change) can affect resources for the living world if biodiversity is lost.

#### SCIENCE AND ENGINEERING PRACTICES AND STANDARDS

##### Engaging in Argument from Evidence

- Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
  - Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge, and student-generated evidence.
  - Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).

##### Obtaining, Evaluating, and Communicating Information

- Obtaining, evaluating, and communicating information in 9-12 builds on K-8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.
  - Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

#### DISCIPLINARY CORE IDEAS

##### LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original state (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS- LS2-2), (HS-LS2-6)

##### LS4.D: Biodiversity and Humans

- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and sustaining life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7), (HS-LS4-6)



# STAGES CONTINUED

## *Students will know...*

- How to differentiate a grass from a grass-like plant based on its vegetative characteristics.
- Which types of grasses or grass-like plants are healthy for an ecosystem by understanding their native or introduced status.
- The different type of human impacts that could affect a grass or grass-like plant community.

## *Students will be able to...*

- Identify a grass or grass-like plant based on its vegetative characteristics.
- Use a dichotomous key to narrow down their findings of a grass or grass-like plant.
- Identify which grasses or grass-like plants are native or introduced to a plant community.
- Understand which grasses or grass-like plants have good forage and cover value for livestock and wildlife, erosion control capabilities, and resilience to the ecosystem.

## Stage 2 – Assessment Evidence

### **Performance Tasks:**

- 1) Students will demonstrate their skills by using field guides, containing dichotomous keys, to properly identify a grass or grass-like plant from a plant community.
- 2) Students will work in groups to conduct a field assessment in a plant community to determine if the ecosystem is healthy or not, based on the identified species.<sup>1</sup>

### **Other Evidence:**

- 1) **Field Journal:** Students will keep an inventory of the plants they observe/collect while conducting their field assessments. Also, field journals will include a Site Description section that will help students evaluate the health of the ecosystem. This may include information about erosion problems from wildfires or human disturbances, forage and cover value for livestock and wildlife, and noxious weed issues. This will allow students the opportunity to determine if the ecosystem is resilient or resistant to these types of changes in the environment.
- 2) **Plant Press:** Students will keep a medium-sized plant press with them during their field assessments. This will allow them to learn the proper techniques of collecting and pressing their grass or grass-like plant. Also, the plant press will enable students to transport plant specimens back to the classroom for further identification.
- 3) **Plant Presentation:** After students have conducted their field assessments of a plant community, each student will select a grass or grass-like plant from the field and share it with the group in either a PowerPoint, poster, or video presentation. The presentation will include information such as the description (e.g., perennial, bunchgrass, height), general information (e.g., forage value, erosion control, habitat type), and similar species (if available).

<sup>1</sup>Information gathered during field assessments will be recorded in the Site Description section of the field journal.





### Stage 3 – Learning Plan

#### Weekly Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
11:00 Students arrive at campground; brief introductions; rules of campground; check into cabins or set up tents 11:45 Lunch 12:20 Classroom meeting (introduce work schedule, class presentations, field journals, get to know each other) 1:00 Start of Field Work 4:00 Field journal entry and classroom meeting 4:15 Free time 5:00 Dinner 6:00 Evening program	7:15 Students wake up 8:00 Breakfast 9:00 Classroom time 9:20 Start of Field Work 12:00 Lunch 12:40 Continue Field Work 4:00 Field journal entry and outside meeting 4:15 Free time 5:00 Dinner 6:00 Evening program	7:15 Students wake up 8:00 Breakfast 9:00 Classroom time (brief review of student field assessments, introduction of how to use a plant press) 10:00 Start of Field Work 12:00 Lunch 12:30 Continue Field Work 4:00 Field journal entry and classroom meeting 4:15 Free time 5:00 Dinner 6:00 Evening program	7:15 Students wake up 8:00 Breakfast 9:00 Classroom time (this time can be used for preparing for class presentations, plant identification, online research related to grasses or grass-like plants, ecosystem resilience and resistance, biodiversity & humans, etc.) 12:00 Lunch 1:00 Continue working on projects 4:00 Field journal entry and classroom meeting 5:00 Dinner 6:00 Evening program: Campfire!	7:15 Students wake up 8:00 Breakfast 9:00 Class presentations, turn in field journals 11:00 Students depart



# LEARNING PLAN | MONDAY

## Goals:

- Students will learn how to pursue careers in the growing field of plant biology, as well as provide knowledge about the role of plants in all areas of life, especially when it comes to identifying the grasses and grass-like plants of Idaho.
- Students and field instructors will introduce themselves to each other and learn to work together as a team.
- Students will work together in teams and understand how to identify the different vegetative and reproductive features of grasses and grass-like plants.

## Essential Questions:

- Why manage for native plant species? Why manage for invasive species?

## Understandings:

*Students will understand that...*

- Making and defending a claim about a grass or grass-like plant species based on evidence from the natural world will allow them to describe their own findings, in detail and with confidence, to other people.
- The field journal and *A Field Guide to Grasses and Grass-like Plants of Idaho* book can help converge on grass or grass-like plant identification and help obtain scientific and/or technical information to help summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

**Science Practices:** *Students will be able to...*

- Engage in Argument from Evidence
- Obtain, Evaluate, and Communicate Information

Students arrive at 11:00. Brief introductions from camp host and field instructors. Discussion of camp rules and field tour. Students check into cabins. If students have tents, these can be set up before dinner.

11:45 Lunch

12:20 Classroom meeting. Field instructors will introduce the work schedule for the week, expectations for class presentations, and field journal entry procedures. Around 12:30, field instructors will assign students to small groups for a “getting to know each other” activity.

1:00 **Invitation:** Have students go out and draw something that looks like a grass or grass-like plant. Encourage them to make note of as much detail as possible. Have students use hand lenses to observe details.

1:20 **Exploration:** Field exercise. In pairs, have students work on their plant identification skills. Ask paired students to gather a grass or grass-like plant sample to share with the group after the exercise. Have students, in pairs, compare the similarities and differences between their samples. Ensure that students have a variety of different grasses and grass-like plant species.



- 1:40 **Concept Invention:** Inform students about the illustrations of grass and grass-like plant vegetative and reproductive features that are provided in their field journals. Also, let them know there is supplemental information (field guides and/or handouts) available if they need it. Field guides and/or handouts will include more in-depth information, such as descriptions, general information, similar species, photographs, and illustrations of the most common grasses and grass-like plants in the area.

Ask students to point out the different vegetative features (e.g., inflorescences, spikelets, ligules), and compare them with the grasses and grass-like plants that the other students collected. This will allow the students to make and defend a claim about a grass or grass-like plant species based on evidence from the natural world, and lets them describe, in detail and with confidence, their own findings to the other students within their group.

**Ask students to consider the following questions:**

- Do you know the difference between a grass and a grass-like plant?
- What are the differences?

**Science Practices Connections:**

- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

- 2:20 **Application:** Have students find and sort grasses and grass-like plants into groups.
- 2:40 **Reflection:** Ask students to reflect on what they have learned, and provide some answers to the question: What are the differences between a grass and a grass-like plant?
- 3:00 Go to an area that has non-native plant species.  
**Invitation:** Before introducing new topic, ask them to consider the following questions: What is the difference between a native and a non-native plant? What does a non-native plant look like? (Don't ask for answers yet, just have them think about these questions as they observe their new findings). Have students spend a few minutes observing the plants in the field. Encourage them to collect a couple of plant samples. Once they are done, have everyone form a seated circle to begin discussion about their new findings.
- 3:20 **Exploration:** In a group circle, have students pass some of the plant species around to encourage observations, questions, connections, and explanations. Have them evaluate the similarities and differences between their samples. Ensure that students have a range of different plant species.
- 3:40 **Concept Invention:** Briefly introduce some of the native and non-native plants in the area. Provide students with copies of the *Idaho's Noxious Weeds, 7<sup>th</sup> Edition* booklet and/or other handouts related to non-native plant species. Have students compare some of the non-native plants they gathered in the field with the plants in the booklet. Have them write down interesting facts or special concerns related to the plant species they found.





# LEARNING PLAN | MONDAY CONTINUED

**Ask students to consider the following questions:**

- Why manage for a native plant species?
- Why manage for a non-native plant species?
- Are there any non-native plant species in our work area?

***Science Practices Connections:***

- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

4:00 Field journal entry and classroom meeting. This will allow students to reflect on what they learned that day.

4:15 Free time

5:00 Dinner

6:00 Guest speaker(s). Presentations will last approximately one hour and can be arranged by either the camp host or field instructors. Guest speakers can be from a government or non-government agency (e.g., USFS, BLM, NRCS, or Land Trust). This gives students the opportunity to learn about the different type of careers that are available with government and non-government agencies, especially in plant biology. Other guest speakers may include a naturalist who knows the history of the area, or an inspiring nature artist. The nature artist can use plants as part of their expression, which may include an activity for the students.





# LEARNING PLAN | TUESDAY

## Goals:

- Students will be able to share their knowledge about the role of plants in all areas of life, especially when it comes to providing insight about ecosystem health.
- Students will continue to work together and gain an understanding on biodiversity and human activities in our living world, as well as have knowledge of ecosystem dynamics, functioning, and resilience, and be familiar with government and non-government agencies.
- Students will communicate their knowledge on how a dichotomous key works, especially when it comes to identifying the grasses and grass-like plants of Idaho. Also, students will understand how to make a claim about a plant they identified in the field and describe it, in detail and with confidence, to other people.

## Essential Questions:

- What impact will biodiversity loss have on humans and wildlife?
- What are some of the complex set of interactions in an ecosystem that keep it stable over long periods of time?
- What makes an ecosystem resilient to disturbance (for example, wildfire) and resistant to dominance of invasive species?
- How can government and non-government agencies work together for the protection of ecosystems and communities?

## Understandings:

*Students will understand that...*

- Making and defending a claim about a grass or grass-like plant species based on evidence from the natural world will allow them to describe their own findings, in detail and with confidence, to other people.
- A dichotomous key will help identify a grass or grass-like plant species, which will lead to solutions to real-world problems based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors.
- The field journal and *A Field Guide to Grasses and Grass-like Plants of Idaho* book can help converge on grass or grass-like plant identification and help obtain scientific and/or technical information to help summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- Grass and grass-like plants contribute to the function of ecosystems, and how they are essential for long-term resilience of Idaho's shrub steppe ecosystems.
- Human impacts (e.g., overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change) can affect resources for the living world if biodiversity is lost.

## Science Practices: *Students will be able to...*

- Engage in Argument from Evidence
- Obtain, Evaluate, and Communicate Information





## DISCIPLINARY CORE IDEAS

- **LS2.C: Ecosystem Dynamics, Functioning, and Resilience**
  - A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original state (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2), (HS-LS2-6)
- **LS4.D: Biodiversity and Humans**
  - Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and sustaining life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7), (HS-LS4-6)

Students wake up at 7:15 and have breakfast at 8:00. Make sure students have the following items for their adventure hike: field journal, backpack, water bottle, sunscreen, insect repellent, rain gear, lunch, etc.

- 9:00 Students meet in the classroom. Field instructors will do a brief review of the materials presented the day before. During this time, field instructors will hold up a grass or grass-like plant and point to some of its vegetative and reproductive features. This will allow the students the opportunity to call out the names of these features, especially before their field assessments on Wednesday.
- 9:20 **Invitation:** Take students on a short hike to an area that has grasses and grass-like plants. In their field journals, have students write down some ideas to the following questions: How would someone identify a grass or grass-like plant species? What type of resources are available to ranchers, land managers, educators, or nature enthusiasts to identify plants? (Don't ask for answers yet, just have them think about the process as they gather their information).
- 10:00 **Exploration:** Field exercise. In pairs, have students work together in collecting a grass or grass-like plant for further investigation. Have them start thinking about how they would identify the grass or grass-like species they collected. (Don't introduce the concept of using a dichotomous key yet, just have them think more about how the process of identifying plants might be done).
- 10:30 **Concept Invention:** Instruct students to review the dichotomous keys that are provided in their field journals. Also, let them know there are other field guides (e.g., *A Field Guide to Grasses and Grass-like Plants of Idaho*, *A Field Guide to Wyoming Grasses*, *Flora of the Pacific Northwest*) and smartphone and tablet apps (e.g., *Idaho Grasses and Grass-Like Plants* and *Montana Grasses*) that have dichotomous keys or filters to help them identify grass and grass-like plants.



# LEARNING PLAN | TUESDAY CONTINUED

10:45 In pairs, have students work together on identifying the grass or grass-like plant they found out in the field by using the dichotomous keys in their field journals or other resources. Ask students to record the steps they used to find their specimen so they can share the process with the rest of the group. Field instructors will provide an in-depth, step-by-step process on how to use a dichotomous key, as well as other resources that are available to help identify the grasses and grass-like plants of Idaho.

**Ask students to consider the following questions:**

- What was the process like?
- Was it easy or hard?
- What resources did you use?
- Were some of the resources easier to use than others? How so?

**Science Practices Connections:**

- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

12:00 Lunch

12:40 Go for a hike to an area that shows both stable and unstable ecosystem conditions.

**Invitation:** Before introducing the topics “Ecosystem Dynamics, Functioning, and Resilience,” “Biodiversity & Humans,” and “Collaboration with Government and Non-Government Agencies,” have students compare and contrast both stable and unstable ecosystem conditions. Also, have them note disturbances (e.g., fire, human, wildlife), non-native species, and influences from land managers.

1:30 **Exploration:** In a group, have students list some of the factors that may be contributing, either negatively or positively, to both stable and unstable ecosystem conditions. Have them list impacts on biodiversity from humans or wildlife (e.g., overpopulation, habitat destruction, introduction of invasive species). Have them provide ideas of how land managers oversee areas that are stable or unstable, especially when disturbed by fire, humans, or wildlife.

**Science Practices Connections:**

- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

2:20 **Concept Invention:** Use field guides and/or handouts to learn more about ecosystem health and resilience, and provide formal definitions, explanations, and new vocabulary regarding biodiversity and humans. Continue with observations of the area showing both stable and unstable ecosystem conditions and share some insight on how management is taking place, especially where the area shows unstable conditions.



**Ask students to consider the following questions:**

**Ecosystem Dynamics, Functioning, and Resilience**

- What are some of the complex set of interactions in an ecosystem that keep it stable over long periods of time?
- What makes an ecosystem resilient to disturbance (for example, wildfire) and resistant to dominance of invasive species?

**Biodiversity & Humans**

- What impact(s) will biodiversity loss have on humans and wildlife?
- What are some of the challenges that wildlife species face due to human encroachment?
- What happens to the native plant species when there is a disturbance in an ecosystem?
- Is there an increase in non-native plant species? If so, how can this be managed?

**Collaboration with Government and Non-Government Agencies**

- How can government and non-government agencies work together for the protection of ecosystems and communities?
- Is this a difficult or easy process? Why might it be difficult?
- Do decisions made by government or non-government agencies affect the people who live within the boundaries of areas protected by law?
- What about areas that are adjacent to areas protected by law?

***Disciplinary Core Ideas Connections:***

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original state (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2), (HS-LS2-6)
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and sustaining life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7), (HS-LS4-6)

***Science Practices Connections:***

- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information



# LEARNING PLAN | TUESDAY CONTINUED

- 3:10 Water/snack break
- 3:30 Take students for a hike to new areas.  
**Application:** During the hike, have students pay attention to areas that are stable and unstable. Take the time to stop at each site to have brief discussions about their observations. Give the students the opportunity to share, with the group, new skills and ideas about ecosystem health, humans and biodiversity, and influences of land management.
- 4:00 **Reflection:** Hike to a quiet place and have students reflect on what they have learned and provide some answers to the questions: What makes an ecosystem stable or unstable? What influence do land managers have in protecting ecosystems and communities? (Let students know that this reflection time is part of their field journal entry procedures).
- 4:15 Free time
- 5:00 Dinner
- 6:00 Guest speaker(s). Presentations will last approximately one hour and can be either arranged by the camp host or field instructors. Guest speakers can be from a government or non-government agency (e.g., USFS, BLM, NRCS, or Land Trust). This gives students the opportunity to learn about the different type of careers that are available with government and non-government agencies, especially in plant biology. Other guest speakers may include a naturalist who knows the history of the area, or an inspiring nature artist. The nature artist can use plants as part of their expression, which may include an activity for the students.





# LEARNING PLAN | WEDNESDAY

## Goals:

- Students will be able to share their knowledge, during field assessments, about the role of plants in all areas of life, especially when it comes to providing insight about ecosystem health.
- Students will work together in the field to gain an understanding of biodiversity and human activities in our living world, as well as provide information related to ecosystem dynamics, functioning, and resilience, and develop knowledge of government and non-government agencies.
- Students will be able to use the “Soil Texture by Feel” flowchart and provide answers regarding soil texture, color, and other interesting soil characteristics.
- Students will communicate their knowledge of how to collect and press plant specimens in the field, especially when it comes to identifying the grasses and grass-like plants of Idaho. Also, students will understand how to make and defend a claim about the plants they observe in the field and describe them, in detail and with confidence, to other people in their group.

## Essential Questions:

- What impact(s) will biodiversity loss have on humans and wildlife?
- Why manage for native plant species? Why manage for invasive species?
- How can government and non-government agencies work together for the protection of ecosystems and communities?
- What are some of the complex set of interactions in an ecosystem that keep it stable over long periods of time?
- What makes an ecosystem resilient to disturbance (for example, wildfire) and resistant to dominance of invasive species?

## Understandings:

*Students will understand that...*

- Making and defending a claim about a grass or grass-like plant species based on evidence from the natural world will allow them to describe their own findings, in detail and with confidence, to other people.
- Grasses and grass-like plants contribute to the function of ecosystems, and they are essential for long-term resilience of Idaho’s shrub steppe ecosystems.
- Human impacts (e.g., overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change) can affect resources for the living world if biodiversity is lost.

## Science Practices: *Students will be able to...*

- Engage in Argument from Evidence
- Obtain, Evaluate, and Communicate Information



## DISCIPLINARY CORE IDEAS

- **LS2.C: Ecosystem Dynamics, Functioning, and Resilience**
  - A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original state (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2), (HS-LS2-6)
- **LS4.D: Biodiversity and Humans**
  - Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and sustaining life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7), (HS-LS4-6)

Students wake up at 7:15 and have breakfast at 8:00. Make sure students have the following items for the field trip: field journal, backpack, water bottle, sunscreen, insect repellent, rain gear, lunch, etc. It is important that students have their field journals for the field assessment. (Information gathered during field assessments will be recorded in the Site Description section of their field journals).

9:00 Field trip day. Field instructors will provide an outline of what to expect from the students during their field assessments. A brief introduction on how to use a plant press and how to make labels will be presented to the students (9" X 12" plant presses will be provided for field assessments). Also, students will do a quick review on how to use a global positioning system (GPS), compass, and clinometer. (Before departure, students will be put into pairs and will be expected to work together the remainder of the day. Make sure each student understands they need to collect their own grass or grass-like plant specimen for their presentations. Students will be allowed to assist each other on plant identification, but it will be the responsibility of the individual to present his/her grass or grass-like plant on Friday).

10:00 Drive or walk to field site.

10:30 Arrive at field site

**Invitation:** Introduce the field site(s) and separate paired students accordingly.<sup>2</sup> Ask students if they have questions before they begin their field assessments. Also, remind them to fill in the information that is provided in the Site Description section of their field journals and to keep in mind the conditions of the ecosystem and influences from management. (Inform students not

---

<sup>2</sup> Make sure students keep a 100' buffer from other paired members. This should allow enough work space to conduct field assessments without overlapping or gathering the same information, especially if they work in different habitat types (e.g., Forest, Wetland, Grassland).





# LEARNING PLAN | WEDNESDAY CONTINUED

to fill in the information regarding soil characteristics until they are finished with all the other questions and the map).

10:45 **Exploration:** In pairs, have students begin observing their site and to start thinking about the questions that need to be answered in the Site Description section of their field journals. (Don't have students answer the questions right away, but to allow them the time to analyze the site in depth).

11:00 **Concept Invention:** In pairs, have students discuss and present arguments based on their observations of the site before they answer each question in the Site Description section. To make sure students are using their field equipment correctly, go around and check on paired students to see what they got for their GPS location, elevation, aspect, and slope information. Share information with students that may stimulate further investigation and curiosity, but don't share everything with them! (In addition to the questions that are included in the Site Description section, have students answer the questions below).

## **Asks students to consider the following questions:**

- Is the ecosystem stable or unstable?
- If a disturbance were to occur, would the ecosystem return to its more or less original state?
- Is the ecosystem resilient? Or would it become a very different ecosystem?
- Are there any non-native plant species present? If so, what are they? How can they be managed?
- Are there any human disturbances? If so, what are they? How can they be managed?

## **Disciplinary Core Ideas Connections:**

- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original state (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2), (HS-LS2-6)
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and sustaining life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7), (HS-LS4-6)

## **Science Practices Connections:**

- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information





- 11:30 **Application:** After paired students have fully discussed their answers, have them record their information in the Site Description section.
- 11:45 **Reflection:** Have students reflect on activities they did the past couple of days to help them provide answers to the questions: How does the current site compare to the other sites that were previously observed? Is the current site more stable or unstable than the other sites?
- 12:00 Lunch
- 12:30 **Invitation:** Introduce the concept of map making. Allow students to make observations at their site, but to keep in mind the importance of creating maps during field assessments. (Make sure students have a compass for this exercise).
- 12:40 **Exploration:** Have students draw a map of their field sites. During this process, have them think about the overall landscape and its important characteristics.
- 1:40 **Concept Invention:** Have students discuss with each other their observations and how they would label the map with important landmark features – meadow, eagle nest, wildlife tracks, non-native plant species, erosion problems. Provide some guidance to map making, but don't share everything you know!

**Ask students to consider the following questions:**

- Why would it be important to create a map for a site description?
- How can maps be used to help managers make future land management decisions?

***Science Practices Connections:***

- Engaging in Argument from Evidence
  - Obtaining, Evaluating, and Communicating Information
- 1:50 **Invitation:** Introduce students to the “Soil Texture by Feel” flowchart. Ask students to think about the soil conditions at their sites and why it would be important to know the soil type for their site, especially for land managers. Make sure students have a dedicated water bottle for soil texturing procedures.
- 2:00 **Exploration:** In pairs, have students go back to their field sites to begin the process of using the “Soil Texture by Feel” flowchart. Have them start thinking about how they would go through each step of the “Soil Texture by Feel” flowchart to determine the type of soil they have on their site.
- 2:20 **Concept Invention:** Have students discuss and present arguments over the type of soil on their site. Ask students to provide results of the soil type that they have and to determine whether it is a sand-, silt- or clay-type soil.



# LEARNING PLAN | WEDNESDAY CONTINUED

## Ask students to consider the following questions:

- Why is it important to know the soil type on a site?
- How does knowing the soil type guide land management decisions?
- How did you conclude the type of soil on your site? What were the steps?
- Were the steps easy or hard when trying to use the “Soil Texture by Feel” flowchart?

## Science Practices Connections:

- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

2:50 Water/snack break

3:00 **Invitation:** Have students independently go back to their sites to collect a grass or grass-like plant species of their choice. Make sure they have their plant presses with them and that they collect more than one species just in case the first attempt is unsuccessful. Advise students to provide important information regarding where the plant was collected.

3:20 **Exploration:** Have students begin the process of looking for a grass or grass-like plant species. Have students think about the overall process of collecting a plant specimen and the importance of cataloging the necessary information (e.g., county, GPS location, elevation) that needs to be included in the plant label.

3:40 **Concept Invention:** Have students clarify the type of plant species they collected before they press the plant. Also, have them label the different vegetative and reproductive parts on the newspaper to see evidence that they know the various morphological features of a grass or grass-like plant. Share information that may stimulate further investigation and curiosity, but don't provide too much information!

## Ask students to consider the following questions:

- What important information should be included in the plant label?
- Why do you think it's necessary to have a plant label?

## Science Practices Connections:

- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

4:00 Field journal entry and classroom meeting. This will allow students to reflect on what they learned that day.

4:15 Free time

5:00 Dinner

- 6:00 Guest speaker(s). Presentations will last approximately one hour and can be either arranged by the camp host or field instructors. Guest speakers can be from a government or non-government agency (e.g., USFS, BLM, NRCS, or Land Trust). This gives students the opportunity to learn about the different type of careers that are available with government and non-government agencies, especially in plant biology. Other guest speakers may include a naturalist who knows the history of the area, or an inspiring nature artist. The nature artist can use plants as part of their expression, which may include an activity for the students.



# LEARNING PLAN | THURSDAY

## Goals:

- Students will understand how to pursue and seek careers in the growing field of plant biology, as well as provide knowledge about the role of plants in all areas of life, especially when it comes to identifying the grasses and grass-like plants of Idaho.
- Students will have the ability to properly identify the different vegetative parts of a grass or grass-like plant, provide insight on how a dichotomous key works, and communicate their knowledge on how to gather and collect plant specimens in the field. Also, students will understand how to make and defend a claim about the plants they observe within a plant community and describe these plants, in detail and with confidence, to other people.
- Students will be able to share their knowledge with other people about ecosystem health and provide insight on biodiversity and human activities in our living world.

## Essential Questions

- What impact will biodiversity loss have on humans and wildlife?
- Why manage for native plant species? Why manage for invasive species?
- How can government and non-government agencies work together for the protection of ecosystems and communities?
- What are some of the complex set of interactions in an ecosystem that keep it stable over long periods of time?
- What makes an ecosystem resilient to disturbance (for example, wildfire) and resistant to dominance of invasive species?

## Understandings:

*Students will understand that...*

- Making and defending a claim about a grass or grass-like plant species based on evidence from the natural world will allow them to describe their own findings, in detail and with confidence, to other people.
- A dichotomous key will help identify a grass or grass-like plant species which will lead to solutions to real-world problems based on scientific ideas and principals, empirical evidence, and/or logical arguments regarding relevant factors.
- The field journal and *A Field Guide to Grasses and Grass-like Plants of Idaho* book can help converge on grass or grass-like plant identification and help obtain scientific and/or technical information to help summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- Grasses and grass-like plants contribute to the function of ecosystems, and how they are essential for long-term resilience of Idaho's shrub steppe ecosystems.
- Human impacts (e.g., overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change) can affect resources for the living world if biodiversity is lost.





**Science Practices:** *Students will be able to...*

- Engage in Argument from Evidence
- Obtain, Evaluate, and Communicate Information

#### **DISCIPLINARY CORE IDEAS**

- **LS2.C: Ecosystem Dynamics, Functioning, and Resilience**
  - A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original state (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2), (HS-LS2-6)
- **LS4.D: Biodiversity and Humans**
  - Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and sustaining life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7), (HS-LS4-6)

#### **Group Discussion**

Students meet in classroom. Have students get together in a group to have a brief discussion about the projects that they will be working on. Briefly review some of the topics they learned about the last few days (e.g., vegetative plant parts, dichotomous keys, and biodiversity & humans). This may help students gain new information or make new connections by listening to other student experiences. Also, it will enable students to get feedback about their projects from other students in the group.

**Provide a rubric so students know what is expected of them.**

#### **Preparation for Projects**

This process will be a student-defined project that will allow students to apply what they know and communicate their ideas more effectively. Also, field instructors will be able to assess their learning progress, as well as provide guidance and academic support for students.

#### **Gathering Information**

Students will have the opportunity to gather information from computers, tablets, and smartphones (if internet service is available), as well as books (see list on page 32), and handouts. Also, students will have the chance to revisit some of their sites, especially if they are missing information or need further clarification on a subject that is or was unclear to them.



# LEARNING PLAN | THURSDAY CONTINUED

## Plant Identification

Students will have the opportunity to use a dichotomous key to identify the grass or grass-like plant they collected out in the field. Also, they can create their plant label for their specimen and attach it on herbarium mounting or cardstock paper. Below is an example of a plant specimen label:

<b>University of Idaho</b> <b>Stillinger Herbarium (ID)</b> <b>Flora of Idaho</b>	
<i>Dactylis glomerata</i> L. POACEAE	
LATAH CO: Robinson Park, found along trail in a shaded area near a rocky outcrop; moderately abundant in patches; associated with <i>Delphinium nuttallianum</i> , <i>Claytonia lanceolata</i> , <i>Ranunculus glaberrimus</i> , <i>Physocarpus malvaceus</i> , and <i>Pinus ponderosa</i> . Bunchgrass with panicle inflorescence.	
N 46°45'13.03" W 116°54'43.52"	
2688 ft.	
Justin J. Trujillo 009	26 APRIL 2013

## Creating the Presentation

Students will have the opportunity to present their subject matter either in a PowerPoint, poster, or video presentation. Computers will be available for both PowerPoint and video presentations. Materials such as cardstock, scissors, staplers, tape, and other supplies will be on hand for students who want to create a poster presentation. Below is a list of items that need to be included in the presentation:

### Introduction

- Study site
- Map
- Grass or grass-like species

### Description

- Life span
- Origin
- Growth habit
- Height
- Inflorescence type
- Spikelets
- Glumes
- Awns



- Sheaths
- Ligules
- Blades

#### **General Information**

- Forage value
- Wildlife cover
- Erosion control
- Habitat type
- Similar species

#### **Field Assessment**

- Ecosystem Dynamics, Functioning, and Resilience
  - Stable
  - Unstable
- Biodiversity & Humans
  - Habitat destruction
  - Invasive species

#### **Conclusion**

#### **Questions**

Below are some example questions that students can focus on when developing their presentations.

#### **Grass or Grass-like Plant Specimen Questions:**

- Which do you have, a grass or a grass-like plant?
- Where did you find your plant specimen?
- Is it native or non-native?
- Is it good for livestock grazing? Palatability? Nutritional value?
- Does it provide cover for wildlife species?
- Does it provide forage for birds?
- Can it be used for restoration purposes? Erosion control?
- What other plants is it associated with?
- Where is it usually found?
- Are there similar species that look the same as this plant?

#### **Field Assessment/Site Conditions & Management Questions:**

- Stable or unstable?
- Signs of erosion problems, fire, overgrazing, or non-native plant species?
- Soil conditions? Soil type? Why is this important to know?
- Animal activity? Wildlife tracks? Scat? Burrows?
- Human encroachment?
- Influences from management?



# LEARNING PLAN | THURSDAY CONTINUED

## **Student Feedback & Outdoor Activity**

Before students turn in their projects, have students work in pairs so they can review each other's work and provide peer feedback. This will allow students to make last-minute changes to their projects before Friday. Once students are done with their projects, have students get together for an outdoor activity.

## **Reflection Period**

In a sitting circle, allow students to share their favorite moments during the week, and how it has helped them understand how to identify grasses and grass-like plants, as well as comprehend topics such as ecosystem health, resilience, and land management. Also, provide some insight about the growing field of plant biology and how exciting it can be to work in the natural resources industry. (Make this session a part of their field journal entry session.)







# LEARNING PLAN | FRIDAY

- 7:15 Students wake up.
- 8:00 Students have breakfast.
- 9:00 Class presentations. Turn in field journals.
- 11:00 Students depart.







# ADDITIONAL INFORMATION

## Field Journal

Field instructors will hand out field journals to the students on Monday during the first classroom meeting. The  $5\frac{1}{2}$ " X  $8\frac{1}{2}$ " field journals will contain approximately 60 pages. Below is an outline of what the field journal will contain:

- “Soil Texture by Feel” flowchart
- Illustrations of vegetative and reproductive features for both grasses and grass-like plants
- Dichotomous keys
- Site Description section
- Notes
- Glossary
- Fill-in-the-blank exercises
- Conversion chart
- Ruler

Field journals will be written in by each student, especially during field activities they participated in throughout the week. Field journals will be turned in on the last day of camp.

## Soil Texture by Feel flowchart

A “Soil Texture by Feel” flowchart will be included in the field journal. By adding this type of flowchart in the field journal, students will learn how to properly texture soil during field assessments and conclude whether it is a sand-, silt- or clay-type soil.

## Illustrations

The illustrations of both grasses and grass-like plants will contain call-outs of different plant parts, which will assist students in identifying these types of plants out in the field. The plant parts will include different types of life forms, inflorescences, ligules, awns, and fruit types, to name a few.

## Dichotomous Keys

The easy-to-use dichotomous keys will give students the opportunity to key out and identify grass and grass-like plants when working in the field.

## Site Description

The Site Description section will contain several areas to fill in information, especially during the field assessment activity on Wednesday. In this section, students will fill in the following information:

- Date
- Observers
- Site ID/name
- Driving directions and general description
- GPS location or coordinates (latitude/longitude)
- Datum
- Elevation
- Aspect
- Slope





- Site location in landscape (e.g., top of watershed, mid-slope, lower slope, floodplain/riparian)
- Soil description – texture
- Color
- Is soil moist or dry?
- Unique/interesting soil characteristics
- Evidence of soil erosion or disturbance
- Animal activity noted
- Vegetative cover distribution (e.g., sparse, even, clumped, patchy, etc.)
- General description of plant community
- Dominant grasses
- Dominant forbs
- Major woody plants
- Noxious weeds present
- Other unique/Identifying characteristics

Once students complete filling in the above information in their field journals, they will sketch out the site with appropriate landmarks.

### Notes

The Notes section will be available for students to write about their experiences they had during each activity they participated in throughout the week. Also, there will be extra blank pages, allowing students to draw grass and grass-like plant vegetative and reproductive features.

### Glossary

The glossary will provide a quick reference to grass and grass-like plant terminology for students when working out in the field.

### Fill-in-the-blank Exercises

The field journal includes fill-in-the blank exercises to test the students' knowledge of the grass and grass-like plant vegetative and reproductive features. These exercises can be done either before field work begins or towards the end of the day.

### Conversion Chart and Ruler

At the end of the field journal is a conversion chart for students. There is also a ruler on the back cover of the field journal just in case students would like to make measurements out in the field.

### The purpose of the field journal is as follows:

- To help students learn about the characteristics of grass and grass-like plants, dichotomous keys, and other terminology
- To assist students during field assessments and additional field exercises
- To allow students to write down their thoughts about what they learned, especially during journal-entry reflection periods



# ADDITIONAL INFORMATION CONTINUED

## Plant Pressing Procedures and Labels

Plant presses can be purchased from [Acorn Naturalist](#), [Bioquip Products](#), or the [Herbarium Supply Company](#). Also, field instructors could build<sup>3</sup> their own plant presses and create their own plant labels. If field instructors want to build their own plant presses, they would need the following items:

- 1 – ¼" X 4' X 8' sheet of plywood
- 20 – 3' NRS HD tie-down straps
- 1 – carton of 11½" x 16½" herbarium mounting paper
- 1 – carton of 12" x 18" standard ventilators
- 1 – SKILSAW
- 2 – 24" contractor sawhorses
- 1 – 25' tape measure
- 1 – straightedge
- 1 – framing square
- 1 – chalk reel
- 1 – carpenter pencil
- 1 – 50' extension cord
- safety glasses
- work gloves

## Equipment List

Field instructors will provide students with the proper equipment for the field assessments and additional field activities. Each working pair of students will be equipped with the following items:

- Global Positioning System (GPS)
- Compass
- Clinometer
- Small bottle of water (for soil texturing)
- Small shovel or spade
- 9" X 12" plant press

## Field Guides, Online Resources, Smartphone Apps, and Computer Software

The list of suggested resources will help field instructors and students identify the grasses and grass-like plants of Idaho. These resources should be provided to the students to allow full engagement with all classroom and field activities. Some field guides are more advanced than others, and should be properly distributed to students who feel comfortable at their learning level. The level of difficulty of each field guide will be labeled as follows: beginner, intermediate, advanced.

<sup>3</sup> Based on a 9" X 12" plant press, one 4' X 8' sheet of plywood could produce approximately 20 plant presses.



### Field Guides

- *Grasses and Grasslike Plants of Utah* by Roger Banner, Mindy Pratt, and James Bowns **(beginner)**
- *Idaho's Noxious Weeds, 7<sup>th</sup> Edition* by Timothy Prather, Sandra Robins, and Don Morishita **(beginner)**
- *North American Wildland Plants: A Field Guide, Third Edition* by James Stubbendieck, Stephan L. Hatch, Neal M. Bryan, and Cheryl D. Dunn **(beginner)**
- *A Field Guide to Grasses and Grass-like Plants of Idaho* by Justin J. Trujillo and Eva K. Strand, Ph.D. **(intermediate)**
- *A Field Guide to Nevada Grasses* by Barry L. Perryman and Quentin D. Skinner **(intermediate)**
- *A Field Guide to Wyoming Grasses* by Quentin D. Skinner **(intermediate)**
- *Flora of Glacier National Park* by Peter Lesica **(intermediate)**
- *Field Guide to Intermountain Rushes* by Emerenciana G. Hurd, Sherel Goodrich, and Nancy L. Shaw **(intermediate)**
- *Field Guide to Intermountain Sedges* by Emerenciana G. Hurd, Nancy L. Shaw, Joy Mastrogioseppe, Lynda C. Smithman, and Sherel Goodrich **(intermediate)**
- *Field Guide to the Sedges of the Pacific Northwest* by Barbara L. Wilson, Richard Brainerd, Danna Lytjen, Bruce Newhouse, and Nick Otting **(intermediate)**
- *Grasses of the Intermountain Region* by Laurel K. Anderton and Mary E. Barkworth **(advanced)**
- *Flora of the Pacific Northwest* by C. Leo Hitchcock and Arthur Cronquist **(advanced)**

### Online Resources

- USDA PLANTS Database: <http://plants.usda.gov/java/>
- Fire Effects Information System (FEIS): <http://feis-crs.org/feis/>
- Utah State University Extension: Range Plants of Utah: <https://extension.usu.edu/rangeplants/>
- WTU Image Collection: <http://biology.burke.washington.edu/herbarium/imagecollection.php>
- Consortium of Pacific Northwest Herbaria: <http://www.pnwherbaria.org/data/search.php>

### Smartphone Apps

- *Idaho Grasses and Grass-like Plants* (Android and iPhone)
- *Montana Grasses* (Android, iPhone, and Kindle)

### Computer Software

- 1225 Weeds of the 48 States & Adjacent Canada: An Interactive Identification Guide (Windows)



# REFERENCES

- Beetles. 2017. Science and Teaching for Field Instructors, Teaching & Learning.  
<<http://beetlesproject.org/resources/for-program-leaders/teaching-and-learning/>>.  
[Accessed 25 November 2017].
- Common Core State Standards Initiative. 2017. About the Standards.  
<<http://www.corestandards.org/about-the-standards/>>. [Accessed 25 November 2017].
- Fire Effects Information Systems (FEIS), U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Science Laboratory. <[www.feis-crs.org/feis/](http://www.feis-crs.org/feis/)>.  
[Accessed 25 November 2017].
- Next Generation Science Standards. 2017. Get to Know.  
<<https://www.nextgenscience.org/>>. [Accessed 25 November 2017].
- USDA-NRCS PLANTS Database. U.S. Department of Agriculture, Natural Resources Conservation Service. <[www.plants.usda.gov/](http://www.plants.usda.gov/)>. [Accessed 25 November 2017].
- Utah State University Extension: Range Plants of Utah. Utah State University, Logan, Utah.  
<<https://extension.usu.edu/rangeplants/>>. [Accessed 25 November 2017].
- Wiggins, G., & McTighe, J. 2005. *Understanding by Design* (Expanded 2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.





