

Pre-Site PowerPoint Slide Notes

Slide #	Notes
1	Title: Doing Science Research in Glacier National Park
2	In a world full of traffic...
3	and sky scraper mountains,
4	where construction seems endless,
5	and the stars are outshined by city lights,
6	there is a need for places like Glacier National Park.
7	2010 was Glacier National Park's centennial year marking 100 years that the park service has worked to protect and preserve five key components of the park, each of which are represented by our National Park symbol.
8	The mountain represents the mountain scenery that the park works to protect.
9	The tree represents the vegetation in the park including old growth forests and wildflower meadows.
10	The lake represents natural resources like fresh air and water.
11	The bison represents the wildlife in the park.
12	And the arrowhead shape represents the park's human history.
13	Glacier National Park hosts over 1,000 native plant species within its borders as well as over 70 species of mammals, and 260 species of birds. The native plant communities are the foundation of this ecosystem and what all other life forms rely on. These plants stabilize the soil and provide nutrients and habitat to other plants, animals, and insects.
14	A major threat to these native plant and animal communities is the invasion of non-native invasive plants.
15	These weeds are among the most Un-wanted. (houndstounge, oxeye daisy, spotted knapweed, st johns wort, butter and eggs, and common tansy) These plants are on the Statewide Montana Noxious Weed List. The list is divided into three categories based on how widespread each weed is. These 6 species are in category 1, which means that they are currently established and are generally widespread in many counties in the state and that these weeds are capable of rapid spread and render land unfit or greatly limit its beneficial uses.
16	We have a huge responsibility in dealing with invasive plants because humans have helped introduce them into the park for over 100 years. Some invasive plant species were planted intentionally by early homesteaders as ornamental flowers. We also transport seeds of invasive plants on our socks and shoes as we hike and on our car tires as we drive into a park. We may also ride horses in the park and horse manure is another means for invasive seeds to be transported.
17	Why should we care about invasive weeds? They can reduce the yield/quality of agricultural crops and grazing capacities for livestock can be reduced up to 90%. Weeds cost farmers in Montana over \$100 million each year in expenses and reduced crop production.
18	Some are toxic to humans, pets, livestock, and wildlife. They may irritate the skin or cause sickness or death if eaten by animals.
19	Invasive plants can take away recreational opportunities in an area. Many invasives cause unpleasant conditions for recreation by limiting access for boating, fishing, and swimming (as seen with the eurasian milfoil above). Other weeds are prickly or have burrs.
20	They can displace native plants, including rare and endangered species.
21	Invasive weeds can diminish wildlife habitat by reducing forage, cover, and water availability.
22	Why should we care about invasive weeds in Glacier National Park? If invasive plants are not controlled, we risk losing some of the very things we are protecting, like our wildlife, plant diversity and recreation opportunities.

23	Your help is needed in Glacier National Park. In order to understand more about these invasive weeds long term studies are necessary but resources are limited so your class is needed to conduct research in the park. Because of the importance of protecting and preserving resources in Glacier, it's necessary to apply for a research permit in order to do a study in the park.
24	<p>Before any official research can be conducted in Glacier, scientists must first get a Research and Collection Permit from the National Park Service. Even if no plants, animals, rocks, or other specimens are being physically collected, scientists still need a permit to collect information in this National Park. Researchers must read and follow application procedures and meet all of the park's requirements in order to get a permit.</p> <p>Researchers must also write a Study Proposal for the research they will be conducting. This report requires scientists to make a plan for conducting their research. It must contain information about when the research will take place, who will be conducting the research, and will give a summary of the proposed projects explaining what exactly they will be doing.</p> <p>Researchers working in an area where cultural resources—like buildings, objects, or structures—are located also need to work with archeologists or anthropologists to complete an assessment on the effects that their research will have on these cultural resources.</p>
25	All of this work must be completed before the work of the actual research and monitoring begins. This ensures that rigorous and well-planned science is done in the park. Our study has been approved by the park and a copy of the "Assessment of Actions Having an Effect on Cultural Resources" form is included in the teacher information for this project.
26	We will be monitoring non-native, invasive plants at two different sites in the park along Lower McDonald Creek. Glacier Park has an "Invasive Weed Management Program" that outlines the park's plan for managing non-native, invasive plants. What's needed to help implement the plan is assistance finding out if and how well, the treatments that are being used are working.
27	<p>The goal of the Invasive Weed Management Program is: <i>To implement an integrated plant management program to preserve the diversity of native plants</i></p> <p>The objectives to meet the goal listed in the Invasive Weed Management Program are:</p> <ol style="list-style-type: none"> 1. <i>Inventory non-native plants.</i> 2. <i>Research their effects on native plant communities</i> 3. <i>Educate people about non-natives</i> 4. <i>Stop introduction of new weeds</i> 5. <i>Reduce the area affected by invasive exotics using different treatment methods.</i>
28	<p>The method for completing the objectives is to:</p> <p>Inventory non-natives already here</p> <p>Monitor to see how they are changing plant communities</p> <p>Evaluate the results of monitoring</p> <p>Manage the affected areas with the best treatments</p>
29	<p>This is where you come in. During your time at Glacier National Park, you will be monitoring specific areas looking for non-native plants. You will also be implementing a treatment - (depending on what weeds are in flower) -hand pulling. Future school groups will be monitoring how well your treatment is working.</p> <p>Comparing your collected data to information obtained in previous years can tell us how the plant communities are changing. Knowing how these communities are changing will help park biologists to determine how to manage, prioritize, and treat the area most effectively.</p>

30	<p>Like any researchers in Glacier, you'll need the right tools to help you collect useful information. A GPS will help you find the exact location where you will be collecting data. A measuring tape will be used to lay out and measure 5 different survey areas at your location. The camera will be used to get a visual record of each area. The 0.25 m² quadrant, the white square in the picture, is called a quadrat and it is used to mark the exact location of each specific plot survey.</p> <p>The exact same areas must be monitored each year to record changes in types of cover and plant species found here. Over time, this information can be used to look for patterns and draw conclusions about the impacts that invasive plants have on a specific area. This data can also be used to make reliable predictions about what will happen in the future.</p>
31	<p>In order to systematically collect data with different school groups each spring and fall, everyone will complete the same data collection sheet. This will ensure consistency from year to year. Here are some things to know to help you fill out the data sheet.</p>
32	<p>Record the names of everyone one in the group and information about your school and grade at the top. Knowing who collected the data and how to contact them is important if any questions arise later. The date is crucial in being able to look for patterns that occur because of the season, amount of daylight, weather, etc.</p> <p>Write legibly!!</p>
33	<p>The location information - transect UTM's, transect letter, and quad number - will be assigned to each group by a ranger when you arrive at Glacier. You will fill that in at your study site.</p>
34	<p>Record weather observations. Why would you want to have a record of the weather?</p>
35	<p>We will spend the majority of our effort collecting data for "percent aerial cover" of the following categories: bare rock, bare soil/gravel, duff, moss & lichen, live grasses, dead wood, duff, shrubs, plus native and non-native invasive forb species, and trees.</p>
36	<p>"Percent Aerial Cover" is an estimate of the percent of area within the plot that is covered or shaded by each category.</p> <p>Let's think about what "percent aerial cover" could tell us about a plant community.</p> <p>Why will recording "percent aerial cover" be more useful information than counting the # in each category?</p>
37	<p>Cover is expressed as % of area instead of counting the # in each category. This will provide a better understanding of their influence on the community. Things like - how much shade they make or how much foliage they have will influence the amount of water and nutrients they use from the soil.</p> <p>Percent cover allows us to see the relative contribution of different non-living things like rocks and debris and life forms such as trees, shrubs, forbs (wildflowers) to the community.</p>
38	<p>We will be using an "aerial coverage" measurement to collect data on plant cover in our plot. Plant cover plays a great role in the amount of sunlight and water that reaches the ground. Plant cover is ecologically significant because it is an estimate of how much a plant dominates an ecosystem. To get aerial plant cover, you estimate how much area of the ground is covered by the extent of the spread of the plant foliage.</p> <p>(Basal Cover is the other type of cover measurement that we will not be using. It measures only the proportion of the plant that extends into the soil. Basal cover is generally more stable from year to year and has less changes due to climatic fluctuation or utilization by grazing animals, but it would be impossible to count accurately in our area because we have many grasses, mosses, and lichens).</p>
39	<p>Knowing the percent cover is useful in the evaluation of hydrologic processes since foliar (leaf) cover influences the amount of rain that is intercepted by plants before hitting the ground. The amount of ground cover (rock vs vegetation or leaf litter) influences infiltration of water and potential erosion.</p> <p>The percentage of "bare rock" is one of the items you will be noting on your data sheet.</p>

40	<p>You will also note the percentage of “bare soil/gravel.” This is most often used to determine the watershed stability of the site as bare soil will erode more easily than soil that has vegetation. In our case, we would be interested to know if the amount of bare soil is increasing with the presence of invasive plants since a well documented characteristic of spotted knapweed is its ability to send out chemicals that prevent other plants from growing around it. Thus, knapweed increases the amount of bare soil around itself and reduces competition from other plants. This allows more room for the spotted knapweed to spread!</p>
41	<p>An advantage of using percent cover for data collection is that it is strongly related to biomass (amount of biological material present) – the more area a plant takes up, the more biomass it has. Plus, it can be used to measure a variety of life-forms (i.e., mosses, annual forbs, shrubs, trees). Another advantage of aerial cover is that it does not require determining the number of individuals within a species so it can easily be used to measure mosses, lichens and ferns at the ground surface. (By the way, moss and lichen are non-vascular plants, ferns are vascular plants).</p>
42	<p>Cover measurements are often used for grasses because of the difficulty in counting grass plants. Cover is one of the most common measures of community composition because it equalizes the contribution of species that are very small, but abundant, and species that are very large, but few (i.e. an area might have a 1,000 individual grass plants and 10 trees but the numbers can be misleading as there are a higher number of grasses, but their percent cover might only be 25% and the tree percent cover is 75%. Which measurement tells you more about the influence of that plant type on the community?).</p>
43	<p>Recording the percent of dead wood gives us information about mortality. It can also be an indication of a past weather event –if a wind, snow storm or fire killed many trees. When trees fall they decompose and add nutrients to the soil. They also open up the canopy so that more sunlight can reach the ground</p>
44	<p>Duff contains decaying plant matter and adds important nutrients to the soil. This is where you would note if there is a lot of dead grass. It also helps to retain moisture. If the duff is really thick, it may impede weed establishment.</p>
45	<p>For plants with less annual variability, such as shrubs – which unlike forbs, do not die back and re-grow each season - cover changes will be due primarily to mortality (death) or recruitment (new plants coming in). Shrubs are distinguished from grasses and wildflowers by their multiple, woody stems. One thing cover measures do <u>not</u> tell you is whether the increased value is due to more individuals coming in, or if it’s just that the ones that have always been there are taking up more space (growing more). For example you may note a 30% increase in percent cover of wildflowers. But is this due to an increase in the number of individual plants- more seeds sprouted and grew? Or is it just that the wildflowers grew larger that year because there was more rain?</p>
46	<p>We will also be collecting data on the percent cover of forbs both our native, and our non-native, invasive species. Rangers will have a field guide with photos to assist you in identifying and recognizing the invasive species. It will be helpful before the field trip if you can identify the 6 focus species in different life stages: with and without flowers, as they emerge from the ground, and what they look like when they go to seed.</p> <p>Of the three measures that can be collected about vegetation—density, frequency, and cover—cover is the most directly related to biomass – how much living material there is. A key advantage of cover as a vegetation measure is that it does not require the identification of the individual (as density does), yet it is an easily visualized measure (unlike frequency). A disadvantage of cover measures are that they can change dramatically over the course of a growing season as plants grow and make more leaves. (Another good reason to make sure you have the date on your data collection form). The change in cover over the course of the growing season may make it hard to compare results from different portions of large areas where sampling takes several weeks to a few months, but it works well if done at approximately the same time each year over a short time period.</p>

47	We will also be documenting the percent cover of live trees. Since cover is highly related to biomass (how much biological material there is) it therefore tells us something about the amount of CO ₂ and light that the plants are capturing and turning into above-ground plant biomass. Similarly, percent cover reflects the amount of soil water and nutrients that the plant can harvest and use (best estimated by canopy cover). Percent cover of trees can influence the amount of sunlight available on the ground for other plants to come in. It affects how much water reaches the ground, and even influences the amount of wind protection there is for other plants. For our purposes, it will be interesting to see whether areas with higher percent coverage of trees have lower percentage coverage of non-native, invasive plants.
48	You'll record more specific information about any trees that are within your quadrat. The size of the trees is measured by using "diameter at breast (or chest) height (abbreviated =DBH).
49	DBH is defined as 1.3 meters from the ground
50	There is a special measuring tape that you will use to find DBH. It's read from right to left when you wrap it around the tree trunk.
51	The notes section is where we can record anything that might be important but hasn't been included in the data sheet. Do you see invasive plants that are growing right next to your quad but not in it? Was your quad dug up by a bear that was foraging in the meadow and has overturned the soil recently? Are there shrubs that have been browsed by wildlife? You'll remember those things now but later when you look back at your data or try to make sense of a strange number you'll be glad you jotted down some notes in the field!
52	You will use the camera to take the required photos . Visual records of survey areas are important in monitoring change. The photos provide more information to help you understand what some of the numbers from previous site visits mean.
53	For example, when you analyze your data, you might find large increases in percent cover for something. But most measures of cover (except basal cover) vary greatly depending on climatic conditions. (Plants can be more vigorous some years and even during the year, the amount of cover will vary with the season – for example, in spring when plants and leaves are just emerging vs in fall when plants are fully grown). So having a photo to also refer to when looking at your numbers, can help you to see what may really be happening. When taking photos, be sure to have the photo identification card clearly visible. This will allow other researchers and park managers to see important information like the date of the photo and where the photo was taken.
54	This picture is not useful for data collection because it is blurry and the data card is unreadable. The picture also cuts out a portion of the plot.
55	While the plot and data card are clearly shown, the clipboard is blocking a portion of the quadrat and taking a picture of the vegetation in the quadrat is the purpose of the picture.
56	Don't forget to take a photo of the front/back of your completed data sheet. This will enable the park to have a back-up record of your data until you have time to enter it into the computer. Also, after doing all this work, you want to make sure it doesn't get lost!
57	Example of bad photo
58	Record today's date and your transect and quadrat again so that this important information is on both sides of the data sheet. Double check that you've completed all of the blanks on the data sheet, that it is neatly written and that the numbers add up.
59	Glacier National Park is 1 million acres in size. Would it be possible to survey the entire million acres for invasive plants? Scientists and park managers often do not have the time or resources to count all the plants in the entire park. Instead, they collect samples of data from the area and use it to extrapolate the information to the rest of the park. Over the years, ecologists have developed complex statistical formulas to use the data from samples to get a good representation of the composition of the whole. Your information from this small study site can help us to predict what might be going on in similar sites in the park.

60	<p>It's important to do the data collection correctly. The data needs to be both accurate (hitting the bullseye) AND precise (being consistent and getting all the hits close together). What's the difference? You could be inaccurate in estimating the percentage of bare ground cover in your survey plot because you counted rocks as "bare ground" when "rocks" is a separate category or you said it was 25% every time that it was really 10% - you were consistent/precise but inaccurate with your wrong answers! Another example is that you identified a daisy as a rose every time incorrectly. So you were inaccurate, but then you did that mistake every single time, so you were consistent – precise – about it. Another example could be that you correctly identified the "bare ground" and the "rocks" as separate categories, but sometimes you said it was 25% coverage and sometimes you said it was 15% coverage for the same amounts – you weren't consistent/precise.</p> <p>What might be the results of collecting sloppy data? (You would get misleading information – if you don't identify species correctly, you might think you have invasive species present when you don't. Vice versa, you might not realize you have an invasive species present if you don't recognize it in your sample). What would be the results from collecting accurate and precise data?</p>
61	<p>Although we know documenting percent coverage can give us lots of good information, it is also been shown to be a measurement that can have lots of variation between observers because cover is subjective and it is difficult to determine the accuracy of the estimate. What helps to make observations between observers more precise (consistent) is for them to use visual cues like grids.</p>
62	<p>We will have percent cover cards that are cut to size to be 5% of the quadrat area, 10%, and 25%. You can use these cards to help you visualize how much space that is.</p>
63	<p>See if you can use the sample data sheet and fill in percent coverage for this quadrat. For simplicity sake, the total should add up to 100%.</p>
64	<p>Remember, this will not be as difficult when you are looking at the real vegetation instead of a photo, but it should give you some idea of how you will really need to think of a method to make sure you are being consistent/precise, and accurate as possible with your percentages.</p>
65	<p>Hand pulling of some non-native, invasives, can be very effective in small areas. We will work together to remove all of the non-native, invasives in a specific area of our research site. The group can decide which exotic (maybe more than one?) and what area of the site. That information will be well documented and before and after photos taken. The site will be re-surveyed in the following spring and fall seasons to continue to monitor how this treatment is working. Hand pulling is just one thing that we can all do to help slow the spread of non-native, invasive plants. It's important to know how to remove them and dispose of them properly. There are many laws about disposing of noxious weed species.</p>
66	<p>After the field trip, you'll enter the data you collected into a Microsoft Excel Google Doc so you can share it with the park and the other schools who will be doing this same field trip in the future. It will also allow everyone helping with this study to analyze the data as it accumulates each year.</p>
67	<p>Once the data is entered into a spreadsheet you will be able to create charts and graphs to display your data in various ways.</p>
68	<p>You will also have access to the data from previous year's field trips and from park staff monitoring and treating the site. This means you'll be able to compare your data to information from past years. You will be able to create graphs that can help you recognize patterns in the data. From your analysis, you'll be able to determine which treatment methods are working best and how plant communities are changing over time. Finally, after analyzing the data, your teacher will assist you in creating a non-native, invasive plant management plan for the site.</p>
69	<p>Congratulations! You have learned about park goals; how to identify invasive species; collecting field data; analyzing the data.</p>
70	<p>As a final step after you've input your data, your teacher may assign you to create a non-native, invasive plant management plan.</p>

71	You should now have a good idea of what you will be doing on your field trip and why. So make sure you come prepared for the trip. Warm layers, including: An extra warm sweater or warm coat, Hat, Mittens or gloves, and a rain coat or a poncho are essential. Sturdy shoes or hiking boots (Shoes must lace up snugly...no skate shoes or shoes without laces), Lunch -Remember what you pack in, you must pack out – and please avoid soda cans or lunch items that are heavy on garbage; and water (a minimum of 1 quart/person)
72	Thank you for participating in the research monitoring project at Glacier National Park and adding to our database. We're looking forward to seeing you!