

Misery Mountain Melting (How Climate Change Affects Ski Resorts)

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Grade Level (Req.): 9	Content Area (Req.): Geography	Unit (Opt.): Climate Zones, Climate Change
Connections to Other Disciplines (Opt.): <ul style="list-style-type: none"> • Math (possible conversion of snowfall amounts from English units to metric or vice versa) • Economics/Business (where is the most logical spot for a ski resort, money-wise?) 		
Time Frame (Req.): 1.5-2 weeks	Goal (Req.): To learn about climate zones & the impacts of climate change	
	Objective (Req.): Students will learn the names of all 12 major climate zones, what each one is like, discuss the argument about whether climate change is human-caused or due to natural shifts, and decide how climate change impacts snowfall at ski resorts.	
Materials Needed (Req.): <ul style="list-style-type: none"> • Internet Access • Climate maps (preferably of USA/Canada) • Topography maps (recommended) • Google Earth 	New Vocabulary (Opt.):	
Anticipatory Set/Introduction [Inquiry Question is required] (Req.): How many of you have ever been skiing before? What problems would global warming/climate change create for a ski resort? What if you could create/build a new ski resort...where would you locate it?		
Instructional Sequence/Procedure (Req.): <ol style="list-style-type: none"> 1. Small group discussion: Explain one of these two situations to your partner: A) describe your last skiing experience, or B) describe the last snowman that you built. What was it like that day? 2. Handout a blank US map, or have students create a sketch map of U.S. on 8.5 x 11 paper. 3. Add 5 Air Mass Arrows (a mass of air of similar temperature and moisture). 4. Classify air masses as Wet/Dry (4 wet, 1 dry). 5. Classify air masses as Cool/Warm/Hot (1 cold, 2 warm, 2 hot). 6. Add large arrow across midsection of US from west to east indicating air mass movement in U.S. 7. Review the major factors that affect climates (latitude, elevation, proximity to large bodies of water, ocean/wind currents, terrain). 8. Review with students what 2 factors need to be mentioned when discussing climates (temperature & precipitation). Also, explain that climate zones do not have fixed boundaries, but transition zones. 9. Have a short discussion to find out how many students think the climate is changing due to human involvement vs. natural cycles. 10. Review the climate zone names. (12 options) Have students think/pair/share in groups of 2-3, assigning at least 2 climates to each group that they then need to explain to the class. (Have them tell what the temp & precip would be like, in general, in each one.) 11. Show a story map of 8 major US cities & have students determine which city lies in which climate zone & explain why (thinking back to the descriptions & air mass arrows). (Make sure there is one city from each zone.) – (storymap.knightlab.com) 12. Explain the situation/essential question (see “other essential info.” on this lesson). Allow students to work in partners if they wish. 13. Show students this website: (share link with them for later reference) - 		

<http://www.forbes.com/sites/christophersteiner/2014/11/18/the-top-10-ski-resorts-in-north-america-for-2015/> to see the current top 10 ski resorts, as ranked by Forbes. (This list is updated every year. As of today, this is the most recent one.)

14. Explain that students will need to research climate data for these 10 cities/places to see which gets the least natural snow, and therefore may be in danger of closing in the future. You could have them use www.intellicast.com as a resource (click on historical averages to see climate data instead of last season's weather).
15. As a class, create a T-chart about things a ski resort needs/wants to have to be profitable (such as a population base, good snowfall, good topography, accessible by road, etc.). Also include things a ski resort does not want (close competition from other resorts, no/few hills or mountains, warm/dry winters, constant danger of avalanches, etc.).
16. Have students/groups start researching for a new ski resort site, keeping in mind the factors from the t-chart you just created. You may want to Google Share that t-chart document with the class for later reference. Students will need to plot their resort into Google Earth to show their final location when presenting to the class. A good website to see where current ski resorts are is: <http://www.wunderground.com/ski/> - this has a map of current resorts, so they can avoid duplicating places.
17. Students will present their findings to the class when finished with the project. I estimate a week or week and a half to complete the climate lessons & research, and 2-3 days to present to the class.

Formative Evaluation (Req.): Pre-Assessment:
Predict which US state has the most ski resorts & explain why. Poll students to see their thoughts on climate change - if they think it is human-caused, natural cycles, or not sure.

Assessment (Req.): Presentation to class and class poll on best spot after hearing presentations.

Iowa Core Curriculum Standards Used (Req.):

- Understand the characteristics and uses of geographic technologies.
- Understand regional boundaries change.
- Understand the global impact of human changes in the physical environment.
- Understand the use of mental maps of physical and human features of the world to answer complex geographic questions.

Common Core Curriculum Standards Used (Opt.):

- Compare and contrast treatments of the same topic in several primary and secondary sources.
- Assess the extent to which the reasoning and evidence in a text support the author's claims.
- Compare the point of view of two or more authors for how they treat the same or similar topics, including which details they include and emphasize in their respective accounts.

NGS Standards Used (Req.):

- How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information
- That people create regions to interpret Earth's complexity
- The physical processes that shape the patterns of Earth's surface
- How human actions modify the physical environment
- How to apply geography to interpret the present and plan for the future
- How to use mental maps to organize information about people, places, and environments in a

spatial context	
<p>Five Themes of Geography Used (Req.):</p> <ul style="list-style-type: none"> ● Location – absolute & relative ● HEI - human impact on climate ● Region - how the US is divided into climate regions 	School District Standards and Benchmarks (Opt.):
21 st Century Universal Constructs (Opt.):	
Other Disciplinary Standards (Opt.):	
<p>Other Essential Information (Opt.):</p> <ul style="list-style-type: none"> ● Students will need to have a background in Google Earth before beginning this lesson. ● Situation: With the advent of global warming/climate change, you have been asked to do two things, since you are now an expert on climates of the world. 1) Predict which of the current “top 10” ski resorts will need to close next, due to increased costs of running snow making machines (as opposed to getting enough natural snow), and 2) find a new location for a ski resort (in the USA or Canada), in a town that does <u>not</u> already have one. After researching, you will use Google Earth to pinpoint your new ski resort & explain to investors why this new location makes the most sense. Keep in mind things that a business like a ski resort would need, other than enough snow, to support the business & keep it profitable. 	
Other Resources (Opt.):	