Special place assignments: connecting ecological concepts to each student's unique locale through scaffolded portfolio assignments.

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UNIVERSITY OF ALBERTA
AUGUSTANA CAMPUS

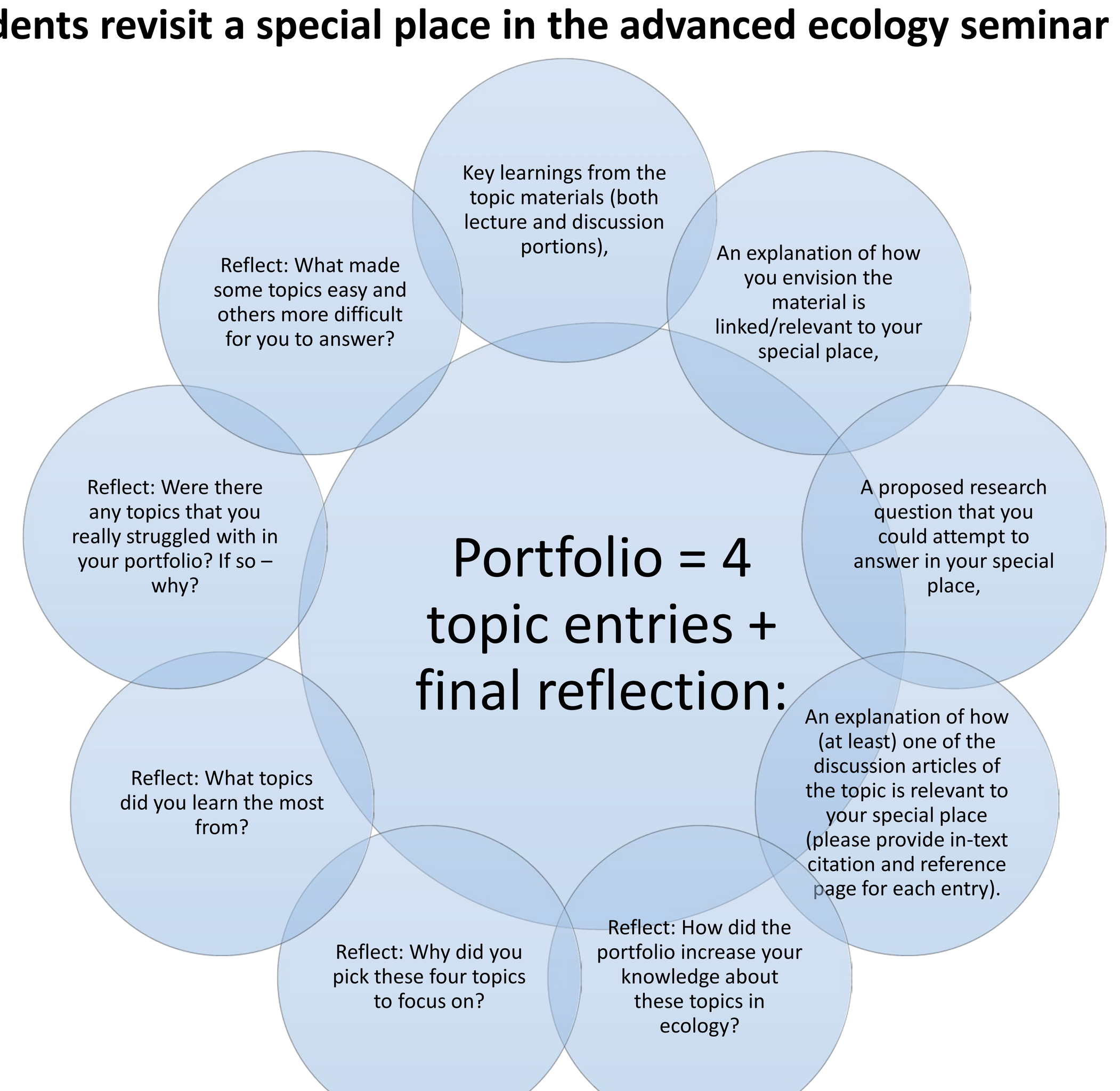
The Augustana Campus of the University of Alberta is located at ᐊᓯᓂᐢᑲᐤ ᓰᐲᓯᐢ (asiniskaw sipisis - Stoney Creek) in Treaty 6 territory. This territory provided a travelling route and home to the Maskwacis Nêhiyawak, Niitsitapi, Nakoda, and Tsuut'ina Nations, the Métis, and other Indigenous peoples.

INTRODUCTION

- Our goal: Provide a cumulative learning activity for students to anchor ecological concepts and ideas to a physical location of significant value to them, ultimately allowing our students to meaningfully comprehend the importance and relevance of the information they learn about.
- We have developed an alternate assessment format in our introductory and advanced ecology courses to help students make linkages between course topics and a physical location that holds special value to them.
- In 2 iterations, there are scaffolded learning opportunities that culminate in a final portfolio document that applies the learned ecological concepts to interactions within their special place. In Winter 2021, the introductory ecology students built a website exploring the ecology of their location and 2 species as their final assessment (in place of a final exam)

Overview of the Introductory Ecology Learning Activity

Students revisit a special place in the advanced ecology seminar course!



Connecting students' learning to their own special places can provide an engaging way to reinforce ecological concepts


Forest at the Hvenegaard Cabin. Credit: L. Hvenegaard

Going into this project, I thought I knew a lot more about the species I chose than I ended up knowing…I thought it would be easier to find information about the species than it truly was, **which highlights to me is that there is still a lot of research that could be done about these species…this also made me have to hypothesize and come up with my own ideas based on class material, prior knowledge and the research I was doing. I think this gave me a deeper understanding of the course material**." L. Hvenegaard

Backyard, Vermilion, AB; Credit: K. Bartley

"Through executing this portfolio, I had to **make connections** with examples we had not talked about in class. Having to do this **enabled me to understand many of the concepts better and in a new light depending on how easily the examples fit the concepts**." K. Bartley


Mount Edith Cavell. Credit: K. Ashton

"I think it is important to be able to **make connections**, and the only way you can create connections is if you have an **understanding** of the information. **By using examples that interest you, your learning will be a lot more fun, and a lot more beneficial in the long run, which I think is very important."** K. Ashton

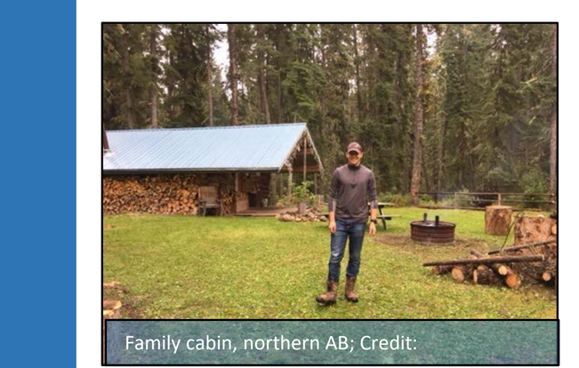

Family cabin, northern AB; Credit: G. Godziuk

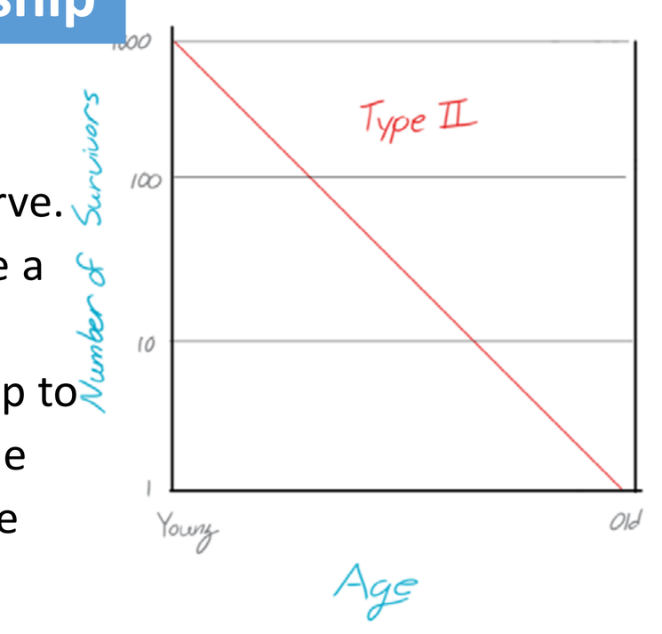
"Everything from topic one to topic eight all has parts which are **interconnected, and it was interesting to see how I could relate each topic to the organisms that I had selected**." G. Godziuk

Click here to access more detailed information

SAMPLE PORTFOLIO COMPONENTS

Intro Ecology: Population Survivorship


Family cabin, northern AB; Credit:



"Ermine (*Mustela erminea*) . Type 2 Survivorship Curve.
The Ermine would likely display a type two survivorship curve. The ermine's kits are independent after 3 months and have a high chance of survival due to the mother caring for and teaching the kits how to hunt. While having a life span of up to 6-7 years, the majority of individuals do not survive past the age of 2. The most common cause of this is due to predation, the ermine's small size makes them an easy prey for most larger carnivores. However, they are very rarely targeted by as they are very aggressive and agile."

Intro Ecology: Temperature & Water Adaptations


Backyard, Vermilion, AB;

Domestic cat (*Felis catus)*
"To adapt to the changing temperature in the seasons in Alberta domestic cats shed their fur when it gets warmer so that they do not over heat and make their coat thicker in winter to counteract the cold temperatures of winter. Cat's have a small intestine that is much smaller than other mammals allowing for quicker metabolism and more energy intake. For water intake domestic cats have a tongue adaptation that pulls liquid into its mouth by exploiting fluid inertia to beat gravity. The tongue has a mechanism based on the properties of water adhesion to the dorsal sides of the tongue. Cats can conserve heat by reducing the blood flow to their skin and lose heat through evaporation by their mouths. They have a minimal ability to sweat and pant for heat relief, but only at high temperatures. Their feces are dry and their urine is very concentrated. These excretion adaptations allow them to retain as much water as possible in their environment. Their kidneys are also very efficient."

Intro Ecology: Exploring an Interaction

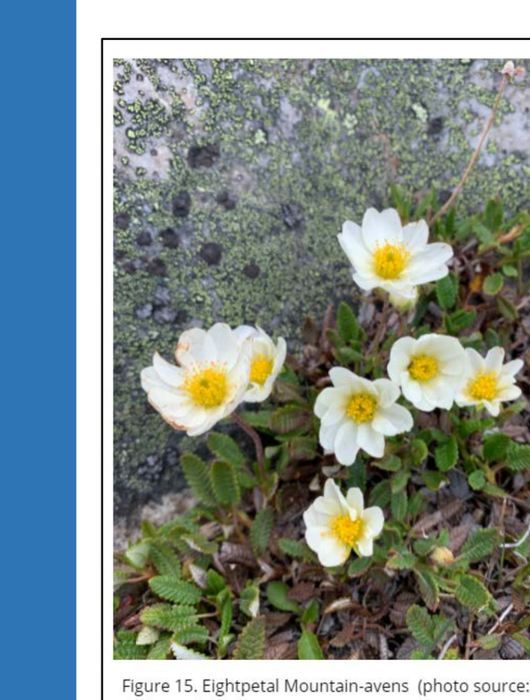
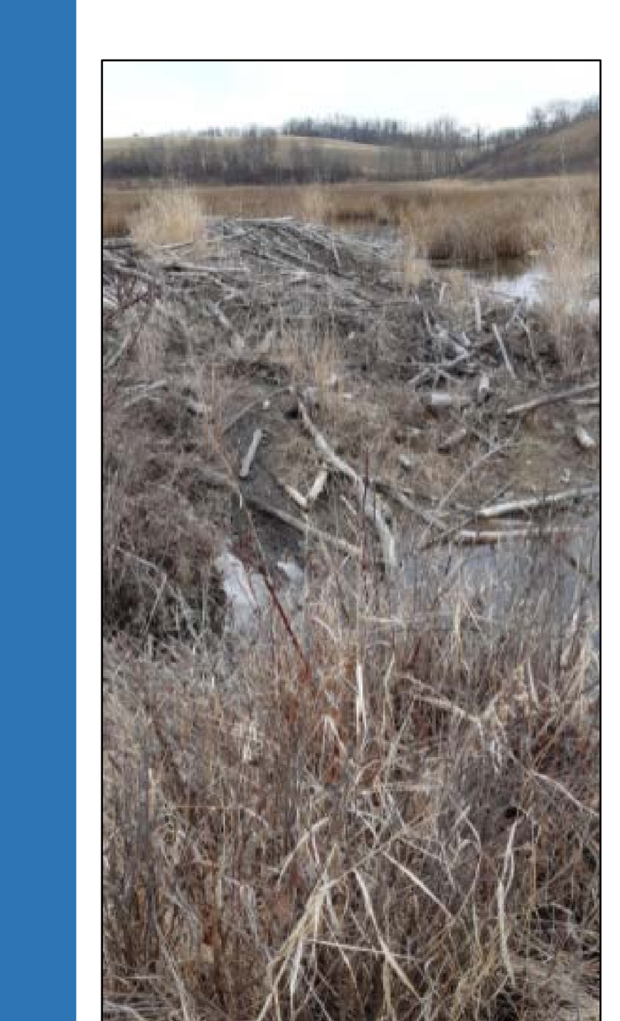


Figure 15. Eightpetal Mountain-avens (photo source: Kallista Ashton).

While working on the nutrient acquisition section for the mountain avens, I discovered that one adaptation that the mountain avens have is the formation of associations with symbiotic, nitrogen-fixing bacteria…This is a mutualistic relationship.. .that is not necessarily obligate, but it is very favorable. This is because in the harsh alpine environments there is low soil moisture and nutrient availability, low soil and air temperatures, and a short growing season which limits plant growth and reproduction (Bjorbækmo et al. 2010). Through the mutualistic interactions between the eightpetal mountain aven roots and mycorrhizae, plant growth can be enhanced. The eightpetal mountain avens are able to improve their nutrient uptake as well as water relations, while the fungus is able to obtain carbohydrates from the roots (Bjorbækmo et al. 2010).

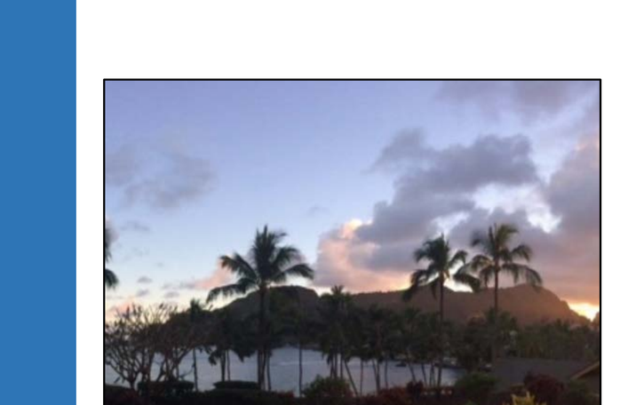
Hypothesis:
From this initial observation and after doing a bit of research, I began to wonder if this was a generalist or specialist type of mutualism. I was curious if there were several mycorrhizal types in a certain area, such as Jasper, Alberta or if there was only one specific type of mycorrhizal. I also wondered if the specific host, the eightpetal mountain aven, had a degree of specificity for mycorrhizal types.
This leads me to my hypothesis:
Given that this mutualistic relationship is highly favorable, yet not completely essential, there is a high chance that it is less host specific and may involve many functionally interchangeable species. Therefore, in an alpine environment with harsh living conditions, I would expect the eightpetal mountain avens to demonstrate a generalist form of mutualism, where they can interact with a variety of mycorrhizal types in order to maximize their nutrient intake.

Intro Ecology: Next steps


Beaver lodge on south pond. Credit: P. Stacey

While looking at beaver lodges through the winter, I have always wondered how well they insulate beavers from the cold winter temperatures. I would like to know how the internal temperature of the lodge compares to the ambient temperature, and how this influences the thermoregulation of beavers. This would be an extension on my knowledge that one function of the beaver lodge is to protect beavers from the elements during hibernation.
To determine this, I would use an observational study. I would record the ambient temperature outside of the lodge as well as inside of the lodge. I would also measure the metabolic rate of the beaver. This would take place during January, which is usually the coldest month of the year; measurements could be taken two times a day, at sunrise (coldest daily temperature) and at 3:00 PM (warmest daily temperature) for two weeks. This would allow for increased changes in changes in the ambient temperature. This study would be conducted on a beaver lodge at my cabin. With these data, I would be able to see how well the lodge acts as an insulator and see how well it minimizes changes in the metabolic rate of hibernating North American beavers.
I believe that the beaver lodge would have a greater temperature compared to the ambient temperature, and that this consistent temperature would allow for hibernating North American beavers to keep their metabolic rate relatively constant through the winter and changing temperatures.

Advanced Ecology Snippet: Predation


Kalapaki Bay, Hawaii; Credit S. Paulgaard (above), Kauai Marriott Resort (below)

…"While I was in Kauai, I noticed plenty of birds walking around the resort and scrounging for food. It would be interesting to examine how feral cats would influence those birds, considering they have overlapping habitats in this situation. A possible research question for predation would be, how are native birds of Kauai influenced by non-consumptive effects from predatory feral cats? These invasive cats connect to what we learned in class, where predator-induced stress can negatively influence the stability of prey populations, possibly reducing the clutch size in birds (Clinchy et al. 2013). The protection of bird species is important to the ecosystem of Kauai, because of their intrinsic and functional value as insectivores, which maintain the insect population. Interestingly, feral cats are one of the major causes of extinction in modern birds, so examining their effect in my special place would help expose the consequences of high cat populations on island biodiversity (Doherty et al. 2016)."

CONCLUSIONS

- Student feedback suggests they find this to be a useful assignment – it helps them make **CONNECTIONS** – which is what ecology is all about!
- By anchoring concepts & ideas to a special place, we think this assignment has the potential to open the door to new ecological ideas & questions that will further student learning.
- We encourage other instructors to adapt these types of novel portfolio assignments to the ecology course that they are teaching. Assignments posted on our website.

ACKNOWLEDGEMENTS

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