Department of Geography

TLEF Sub-project: Interactive Alpine Ecosystem Module with ESRI Storymaps

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Alpine Ecosystem Education

This work is a sub-project of the main project to create digital immersive field experiences (augmented and virtual reality) of BC alpine and coastal forest ecosystems (Hewitt TLEF 2019). In 2020, we expanded the project to include study sites in the Central Karakoram-Himalaya. Data included species' historical range limits (Dainelli 1928) and modern, 20th century, distribution and abundance data (Hewitt 2016) in the region as a means to assess species' range changes (Fig 1).

The dilemma was how to make this complex biogeographical information accessible to undergraduate student audiences. To address that challenge, we employed a digital storytelling platform, ESRI Storymaps, to provide an interactive, procedural walk-throughs of varied topics.

Fig. 2: Storymap showing study location in the Central Karakoram.

The Tools:

Our Storymap guided students through field and lab methodology using engaging and interactive components, such as the researcher's data collection processes and diversity metrics. Embedded external web materials allows for customization of the Storymap and better student interaction. We showcased a customized, interactive DEM using ArcGIS Scene Viewer (Fig. 2), and therefore embed a geographical and spatial narrative for the project.

Embedded Storymap Elements for Alpine Ecosystem Learning

- The 3D DEM map allows students to interact with data on the distribution and abundance of 10 focal species, and compare these to shifting elevation limits. Students can toggle controls to reveal different subsets of species and compare them (Fig. 2).
- Jupyter notebooks, an online coding and markup interface in HTML format (Fig. 3) enables students to compute similarity and diversity indexes by adjusting and running notebook code.
- Graphs of species abundances by elevation in Hewitt's 2016 study sites facilitate visualization of alpine floral distributions, and is accompanied by spreadsheet data for further examination (Fig. 4).
- Google sheets and forms are integrated into the storymap, where students can enter and submit, via a linked online submission page, their answers to assessments (Fig 5).

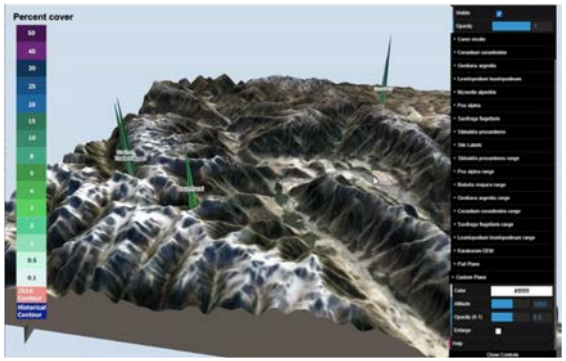

Fig. 2: Interactive 3D modelling created in QGIS and exported to an HTML and hosted on Github pages

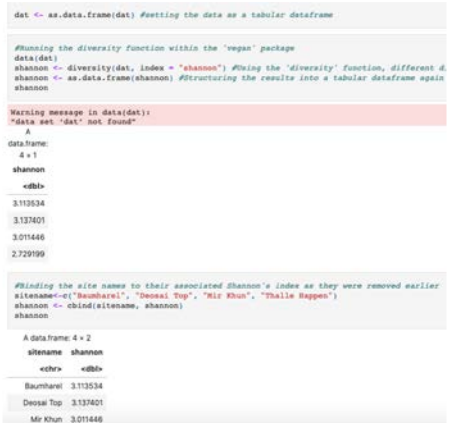

Fig. 3: Annotated walkthrough of simple R code in Jupyter Notebooks.

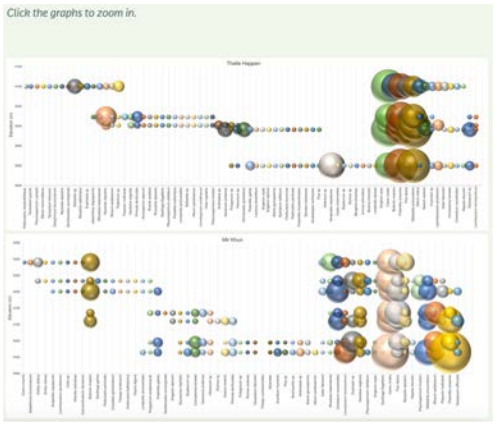

Fig. 4: Embedded graphics of species abundance plotted against elevation. Bubbles size reflects abundance.

Conclusion

With Storymaps, 3D DEM's, Jupyter Notebooks and Google sheets or forms, students may explore and interact with complex information about species populations in an alpine area. They can compute diversity metrics and interact with data on species historical and current range limits to predict climate induced range shifts. This open education resource is available under a CC-BY-NC-SA licence.

Similarity Indices

	Altitudinal range (m)	Jaccard	Sorensen	Bray Curtis
Between quadrats	3900-3991	0.28723404	0.44628099	0.30092593
	3991-4002	0.14492754	0.25316456	0.41408451
	4002-4023	0.28915663	0.44859813	0.30263158
	4023-4100	0.18055556	0.30588235	0.42930591
Between 100m bands	3900-4000	0.15555556	0.26923077	0.46135831
	4000-4100	0.22891566	0.37254902	0.40359897

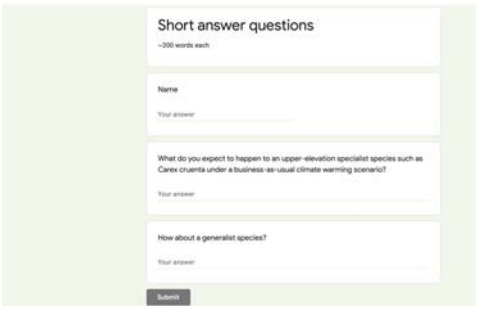

Fig. 5: Tabled data and Q-A prompts are embedded and linked to online submission forms via Google sheets.

References

Hewitt, N. 2016. Unpublished data
Dainelli, G., O. Marinelli (1928) Collections of Plants and Animals. Scientific Reports of the deFilippi Italian Expedition to the Himalaya, Karakoram & Chinese Turkestan (1913-14)]. In Pampinini, R., D. Vinciguerra (eds.), Ser. 2, Vol. 10. Zanichelli, Bologna.

Acknowledgement

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