

Groundwater Vulnerability Assessment of War Fork Watershed in Daniel Boone National Forest



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Introduction

All across Daniel Boone National Forest, there are karst features such as caves, springs, and sinkholes that all play a role in the groundwater and surface water interactions. These karst characteristics allows more accessibility to these groundwater systems, which increases the potential for them to be more vulnerable to contamination. These features paired with the mixed land use of a National Forest make this land both environmentally and economically valuable. The vulnerability of the War Fork Watershed is one example of a model that can be used elsewhere across the National Forest and rest of the state.

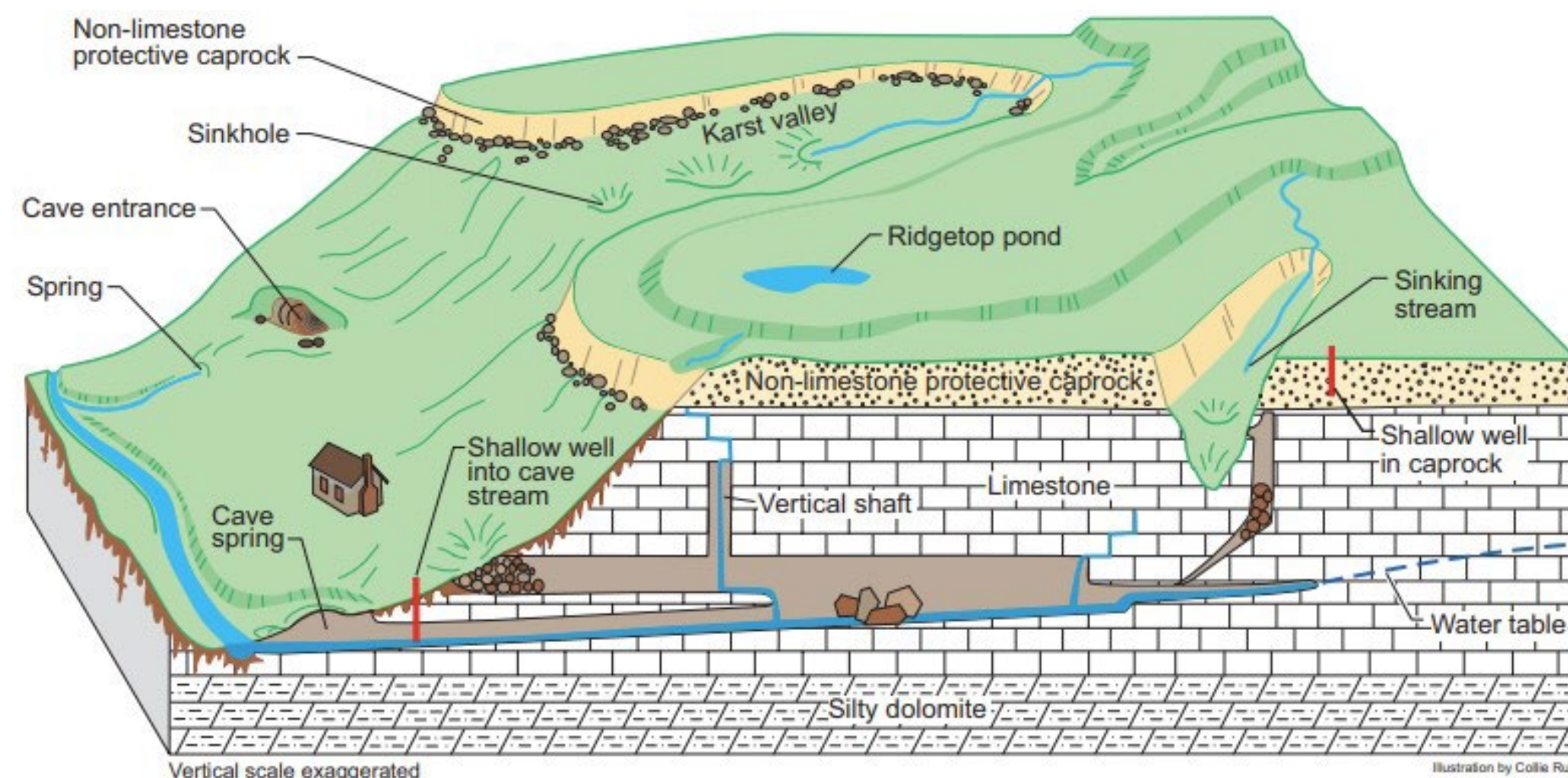
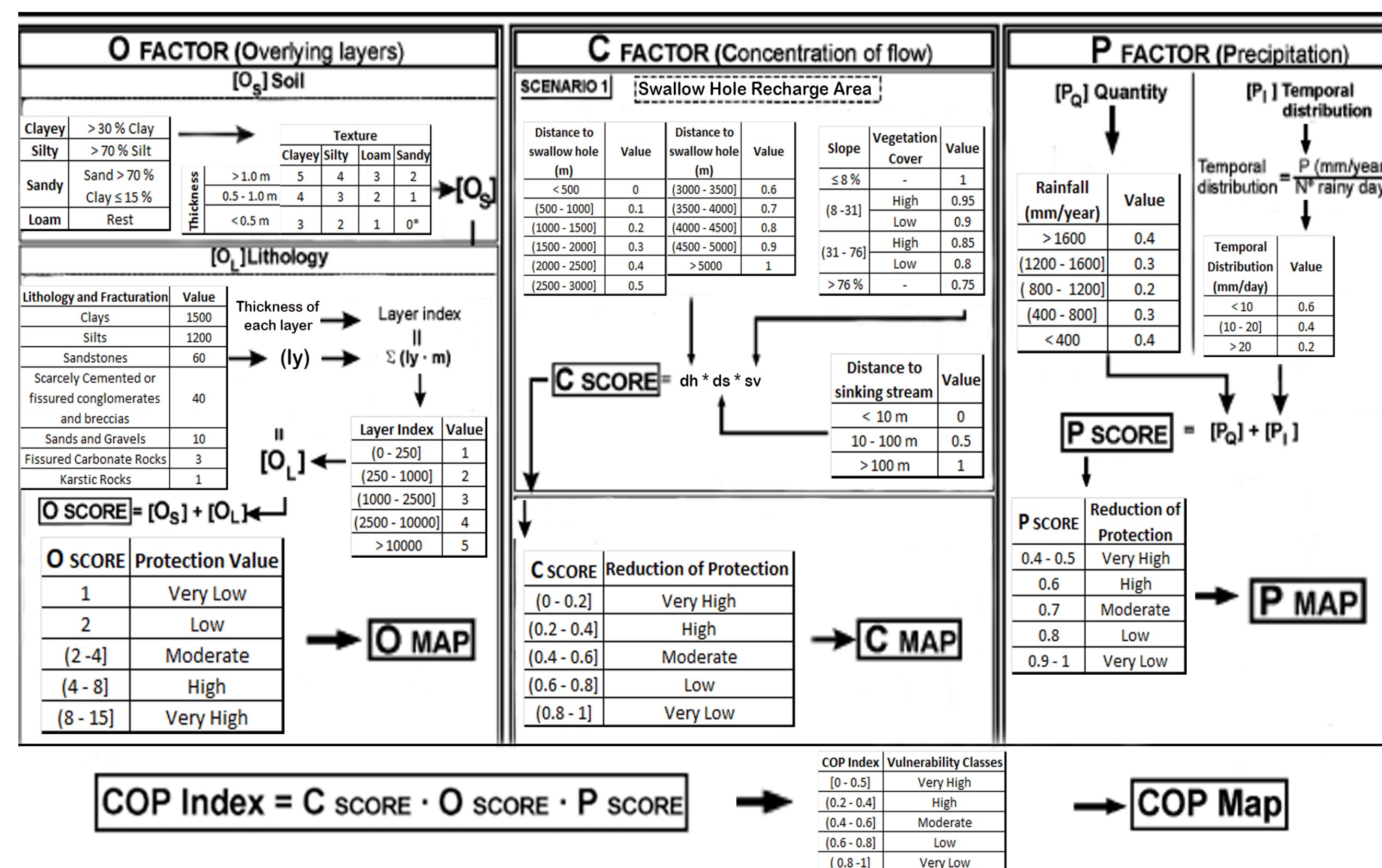


Diagram of Eastern Pennyroyal Karst Processes and Interactions: (Currans, 1995).

Methodology



(Vias et al., 2006)

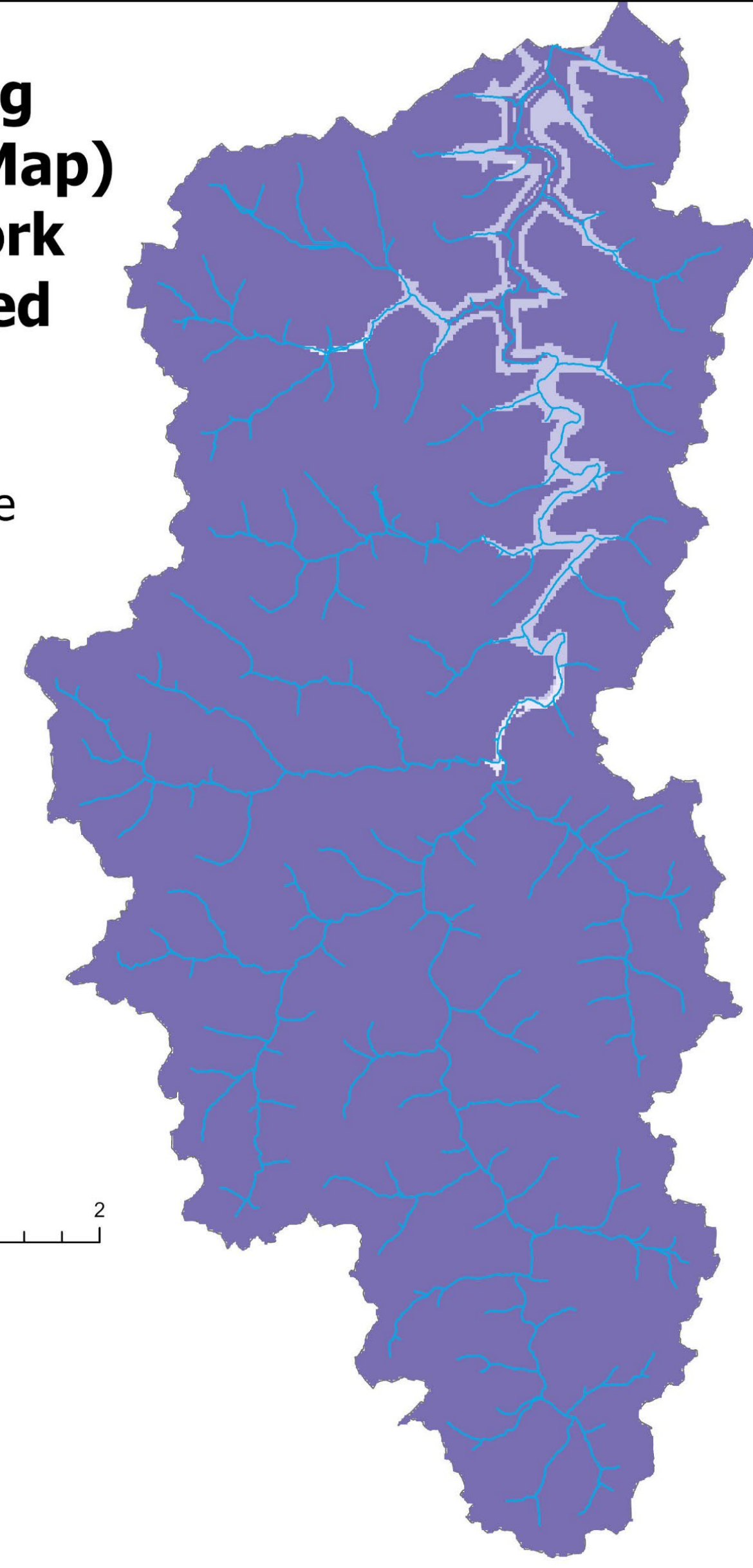
All the spatial data was compiled and calculated using the ArcGIS Pro Mapping Software and Model Builder in order to combine datasets.

Overlying Layers (O Map) of War Fork Watershed

Protection Value

- Low
- Moderate
- High
- Very High

War Fork Watershed



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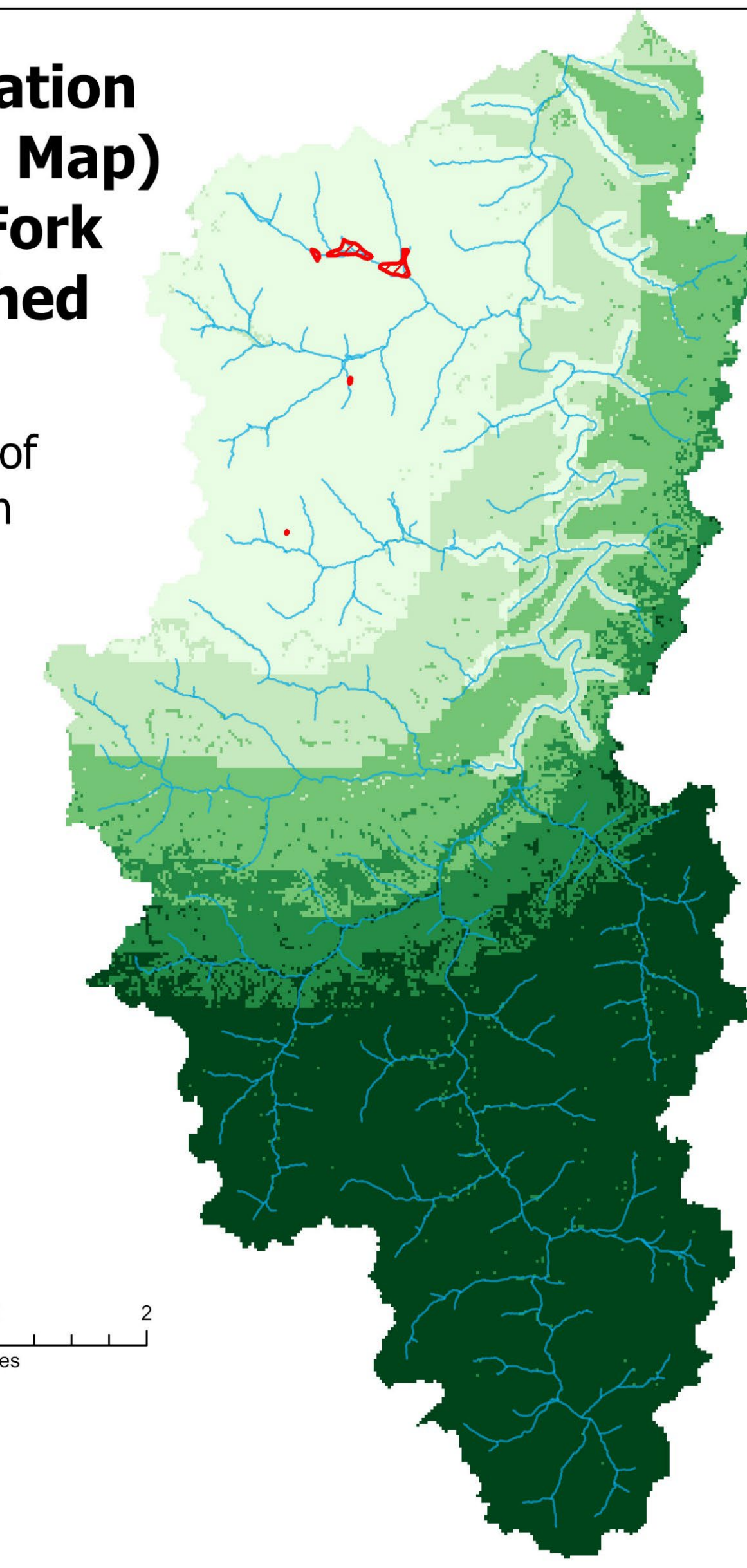
Concentration of Flow (C Map) of War Fork Watershed

Reduction of Protection

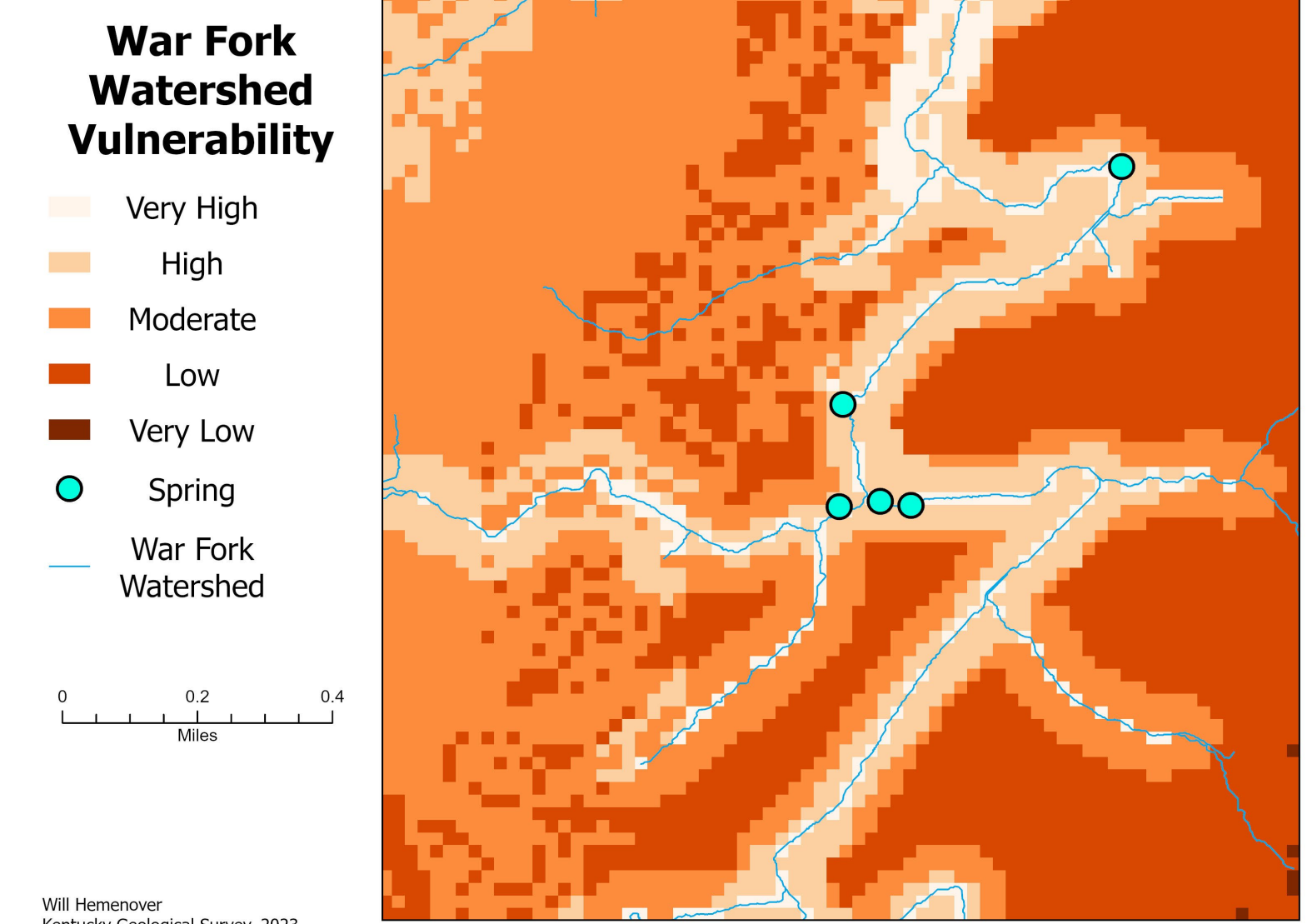
- Very High
- High
- Moderate
- Low
- Very Low

Sinkhole

War Fork Watershed



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Key Findings

Located above are the field-identified springs locations containing potential for dye trace connections, which are situated in higher or very high vulnerability, but surrounded by moderate to low vulnerability.

Discussion

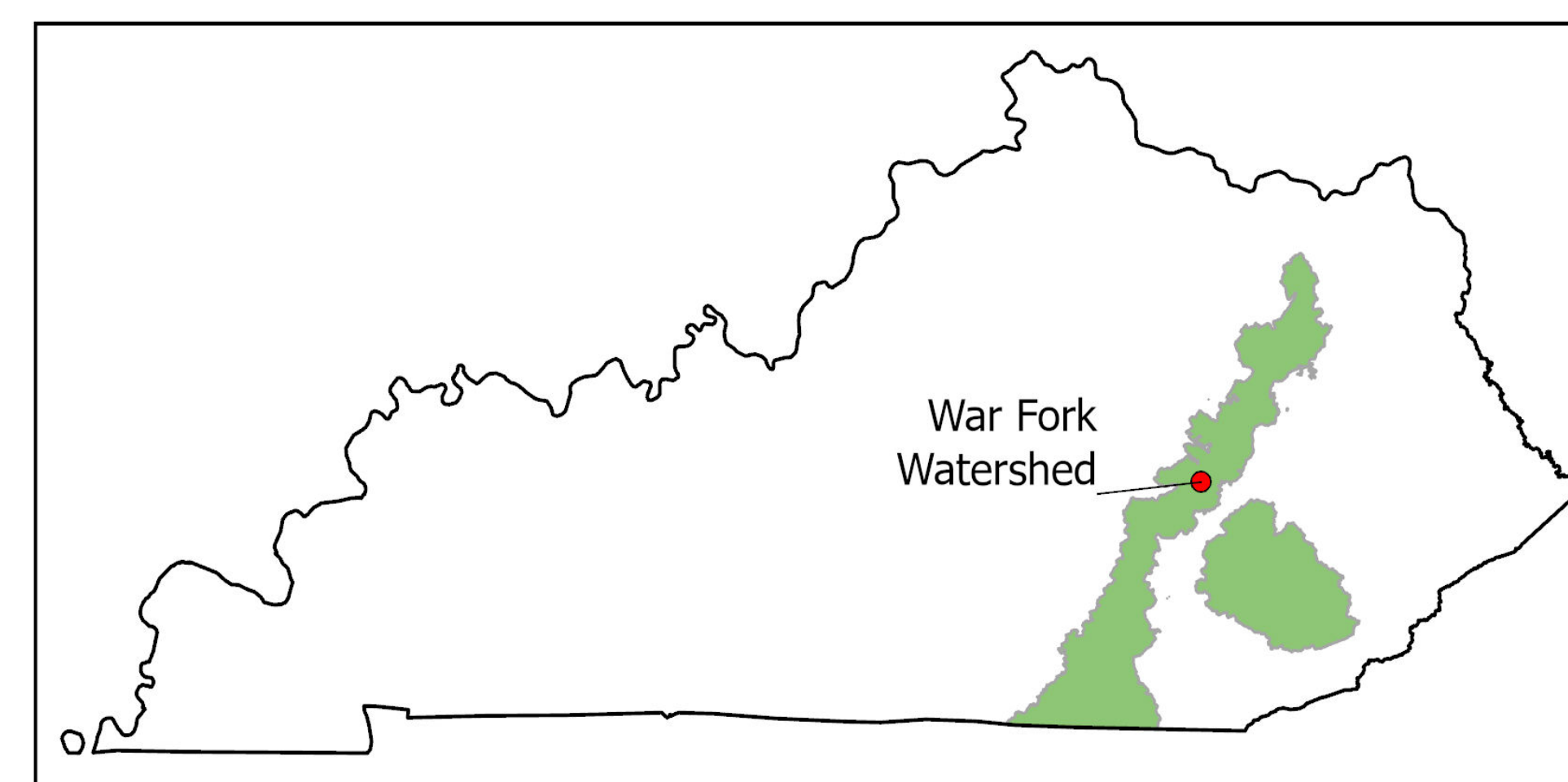
- There is a higher degree of vulnerability directly on the karst, a result of the presence of sinkholes.
- This can assist land managers with informed decision making in extracting resources with the lowest amount of impact and be able to add protections or regulations to protect these unshielded environments.
- Continued modification to this model will be made with the addition of karst features located in the field, along with dye trace results.
- Dye traces in this study area, with a defined time that the dyes take to travel in the karst will allow a better understanding of the vulnerability of the region.
- The next steps of this project will be presented at GSA and will be used to complete an undergraduate thesis at WKU.

COP Model of Watershed Boundary

Vulnerability Classes

- Very High
- High
- Moderate
- Low
- Very Low

- Spring
- Sinkhole
- War Fork Watershed
- Daniel Boone National Forest



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References

Currans, J. C. (1995). Generalized block diagram of the Eastern Pennyroyal Karst. UKnowledge. https://uknowledge.uky.edu/kgs_mc/17/

Jones, N. A., Hansen, J., Springer, A. E., Valle, C., & Tobin, B. W. (2019, November 11). Modeling intrinsic vulnerability of complex karst aquifers: Modifying the COP method to account for sinkhole density and fault location - hydrogeology journal. SpringerLink. <https://link.springer.com/article/10.1007/s10040-019-02056-2>

Vias, J. M., Andreo, B., Perles, M. J., Carrasco, F., Vadillo, I., & Jimenez, P. (2006, February 11). Proposed method for groundwater vulnerability mapping in carbonate (karstic) aquifers: The cop method - hydrogeology journal. SpringerLink. <https://link.springer.com/article/10.1007/s10040-006-0023-6>

Acknowledgments

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