MAGIP Higher Education GIS Scholarship Application

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A Study of *Camassia quamash* on the Flathead Indian Reservation – Habitat Suitability Modeling in ArcDesktop

I. INTRODUCTION

a. Blue camas was a subsistence crop for many indigenous people throughout the Northwest of North America. Yearly gathering and baking was conducted and resulted in sites where many people lived in large communities at a certain part of the year for harvesting and baking of camas bulbs. The ceremony and tradition associated with gathering extends deep into the oral histories and resulted in a highly developed relationship with this plant and the surrounding ecosystems for the peoples relying on this significant lily species. Due to this plant's high cultural significance there is an urgent need to conserve, restore and preserve camas habitat for future generations.

b. Numerous articles state "annual floodplains" as the key hydrologic feature and wet prairies, meadows, hillsides as characteristic landscape features (NRCS and USDA 2001; Stevens et al 2001; Craighead et al 1963). Additionally, Stevens et al states "full sun to partial shade" as one of the requirements for camas to establish (Stevens et al 2001). Moist soil conditions (especially ephemerally moist) or equivalent irrigation were also contributing factors to camas establishment. Some authors have May to June as the blooming period (Kershaw and Pojar 1998). Geophytes, like *C. quamash,* characteristically survive unfavorable periods for growth by "dying back" to underground storage organs such as tubers and bulbs (Rundel 1996). This period is known as quiescence, which is defined as quiet, inactive or dormant (Anon).

   Anthropogenic disturbance was a major influencing factor on camas through management practices such as burning (Stevens et al 2001; Beckwith 2004), which is acknowledged as a highly important disturbance factor for plant communities (Barrett and Arno 1982; Agee 1993). Transplanting, tilling, and irrigation were also common practices implemented by peoples relying upon native plant communities for subsistence (Anderson 1996; Anderson and Moratto 1997). These disturbances change plant communities from landscape scales all the way down to individual scales. Succession is highly affected by disturbance (Johnson and Miyanishi 2010), with "earlier stages of succession" being purposefully maintained as a strategy to maintain shade-intolerant plant communities (Anderson 1996).

   The temporal strategy for burning practices employed for camas meadows is still an area of this flower's ecology that is relatively poorly understood. In a 2006 article Linda Storm and Daniela Shebitz qualified the need for burning during the fall, as opposed to spring season burning (Storm and Shebitz 2006). The frequency is still an area that is in need of further research, i.e. whether or not burning was done every year or every other year. Despite this lack of research there is ethnohistorical records that indicate the burning occurred every year (Beckwith 2004; Storm 2006; Storm and Shebitz 2006).

c. Due to the aforementioned ecological characteristics of this plant species it is a strong candidate for indication of wetland abundance. Since this plant is observed to be in drastic decline and there has also been an observed decline in wetland

ecosystems there is strong evidence to support the idea of using this species as an indicator of both wetland decline and also restoration. Since this species is both culturally and ecologically significant the need to preserve current and future habitat is overwhelming.

d. The integration of site measurements and further traditional ecological knowledge of *C. quamash* will increase the predictive capabilities of a habitat suitability model to the precision that would provide a geospatial framework for a confident assessment of current camas habitat for conservation and restoration purposes.

II. Methods

a. The four sites for measuring of *C. quamash* habitat characteristics are located on the Flathead Indian Reservation (Camas Prairie, Kicking Horse, Jocko, Evaro)

b. The species of focus is *Camassia quamash*

c. The field sampling will include measurements of buffer distances, plant indices, soil types, elevation, and camas meadow boundaries for statistical analyses and input into a model constructed using ArcDesktop 10.2.

d. The tools used in this model include but are not limited to: clip, extract by mask, weighted overlay, union, buffer, extract by attribute, add field, dissolve, feature to raster, and reclassify.

e. Statistical analyses will be performed on the various ecological values that are used as inputs into this model and will include linear regressions to quantify the ratios and significance of these characteristics in relation to camas abundance.

f. This method will provide a working model for practical application of maps that show precise locations of suitable camas habitat for the purpose of conservation, restoration and preservation of current and future camas habitat. This type of predictive modeling has not been done for the Flathead Indian Reservation and will allow future research to be conducted with a geospatial modeling framework based off of field measurements.

III. Expected Results and Conclusion

a. Interpretation of maps created using this model will include site visits to known locations to evaluate the efficacy of the model at currently identified camas locations.

b. Further evaluation will include visits to previously unknown sites identified by the model as suitable camas habitat to confirm/deny the existence of suitable habitat and/or established camas meadows.

c. Statistical analyses will include linear regressions in order to conceptualize the ratios of certain habitat characteristics such as soil types, moisture levels, land cover type, and camas abundance/distribution.

d. These data will build upon previous habitat predictions from the model and will give strong justification for a more concerted effort to be made for further research and restoration of this highly important species.