Photo Credit: Scott River Watershed Council Webpage

Cross-Sectional Generational Comparison of Restoration Perceptions in the Scott River Watershed, California

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Abstract

Changes in the local climate and landscape of Scott Valley, California require the attention of government entities, the community, and local landowners to adapt and respond to current and projected hydrologic system disruptions. Surveys were administered and collected to better understand the perceptions of local landowners within the Scott River Watershed, regarding their landscape and views on restoration. An identical survey was administered and collected from local high school students, as they are likely the ones to be future landowners in the Scott River Watershed. From the results of the survey, the responses from the two groups were compared. This data may be used to support future restoration project managers in understanding the perceptions of residents living within the Scott River Watershed. Along with this, to understand the current climate conditions and to predict climate changes, a climate adaptation plan has been constructed for the Scott Valley.

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I. Introduction

River restoration and water quality have been identified as primary concerns in the Scott River Watershed (SRW) of Siskiyou County, Northern California (SRCD, 2005). Siskiyou County is demographically a majority white population, the economic driver of the SRW is primarily agricultural, and the SRW is a part of the Shasta Indian Nation. The SRW is a tributary of the Klamath River and is notable for its 274 miles of salmonid habitat and 813 square miles of land coverage in the Klamath Mountain range (SRCD, 2005). The SRW is an ecologically and geologically diverse environment with management issues concerning upland vegetation conditions, fuel management, wildlife, and economic development.

The Moffett Creek Watershed MCW and other tributaries of the Scott River are focus areas for restoration efforts by the Scott River Watershed Council (SRWC) and Southern Oregon University. Moffett Creek, a subsidiary watershed of the SRW, located east of Fort Jones, California is a mix of private land ownership, timber harvest, agriculture, and public lands. Moffett Creek has been identified as a critical area of study due to its extensive history of landscape alteration and destruction of environmental processes from road construction, logging, overgrazing by cattle, channel straightening and leveling, floodplain modification, fire suppression, recent prolonged droughts, and groundwater pumping (Ford, et al., 2019). The story of MCW is echoed in other tributaries in the SRW which share similar terrain, demography, land-use patterns, and history of ecological system dismantling for economic development.

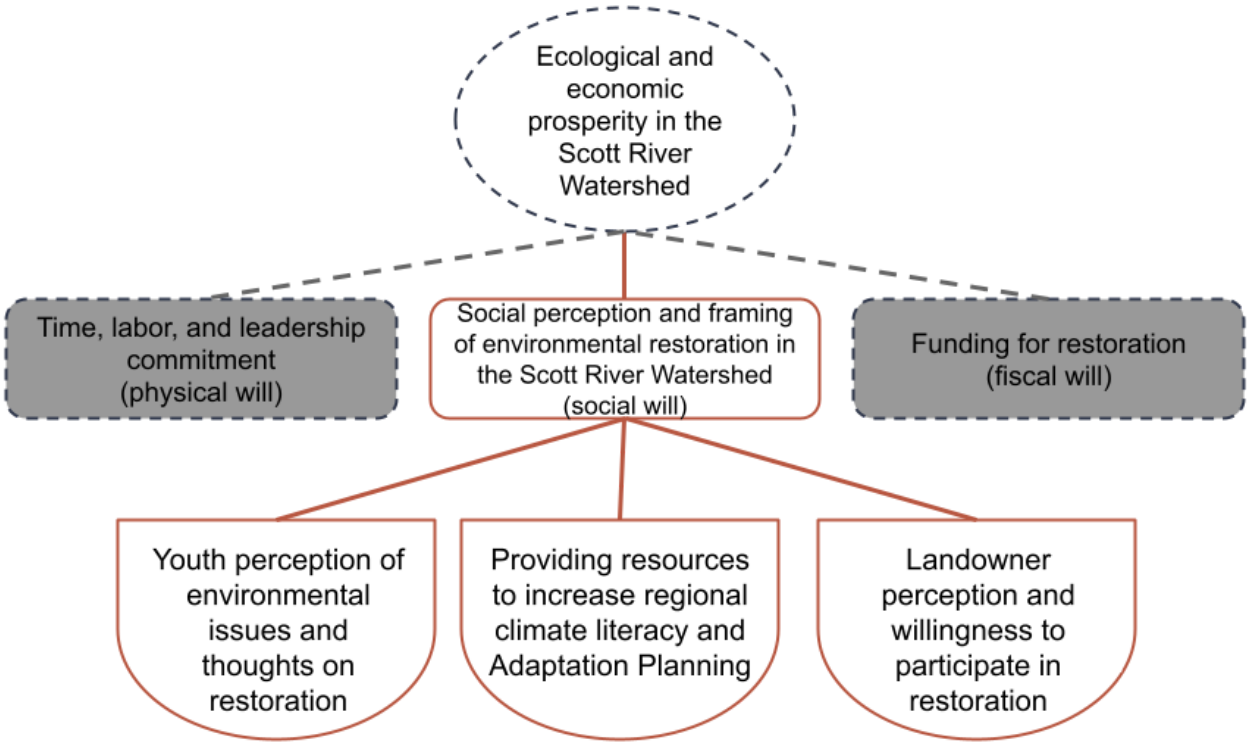
As soon as the 1950s, Moffett Creek lost perennial flows due to groundwater depletion (*Kier Associates, Sausalito, and Arcata, CA*, 1999). Loss in perennial flow subjects the creek to reduced riparian vegetation, decreased meandering ability, and periods of high turbidity after rainfall (Ford, et al., 2019). Sediment disturbance events lead to bank erosion and clarity loss in rivers far downstream of Moffett Creek (*Kier Associates, Sausalito, and Arcata, CA*, 1999). A primary restoration goal is to recharge groundwater through beaver dam analogs or beaver ponds which have shown to elevate the water table in the SRW. Bank stabilization, upland vegetation diversity, and levee removal are further desired projects to promote perennial flow and salmonid habitat, however, perennial flow is unlikely to occur until water table levels are returned to their pre-1950 levels (Ford, et al., 2019; *Kier Associates, Sausalito, and Arcata, CA*, 1999). Understanding landowner perception of restoration will aid in determining how restoration efforts are framed in the SRW.

In the SRW, water quality and salmonid habitat restoration are priority focuses for land managers and restoration projects (SRCD, 2005). River restoration projects proposed by the SRWC would include the participation of private landowners for river access and these areas

have already been identified (Grant, et al., 2019). The aim of this study is to understand how the agricultural community of the SRW perceives ecological restoration and the local environment as well as proposed solutions to these issues. With the ever-changing landscape of the SRW and the need for restoration projects, an understanding of current landowner environmental and restoration perceptions will benefit projects in the future. Landowner perception may change over time and across generations. This is why we have broadened the scope of the study to include the younger generations in the SRW. The younger generations in the valley will likely be the ones that have a lasting impact on the strength of future restoration projects. Figure one (below) provides an overview of the efforts required in the SRW to produce a community-supported aquatic restoration management plan. This research on social perception across generations will aid in understanding the community in the valley, their framing of the land, and their levels of support for ecological restoration projects.

A. Research Overview Diagram

Figure 1: A diagram showing how this research fits into larger goals in the Scott River Watershed.



Site selection, feasibility, accessibility, and longevity of ecological restoration ought to be evaluated with social, economic, and sense of place context included from the early stages of project design during restoration projects. The inclusion of social and economic benefits to restoration work alongside ecological benefits from the outset of a project proposal can

encourage more resilient institutional structures (Johnson, et al., 2017; Smith, et al., 2014). By learning the current mindset, opinions, and view that landowners and the younger generation hold, researchers will be able to advise the SRWC towards successful restoration projects that take economic and social factors into consideration. Studies show increased public participation in restoration management prioritizing the social and economic benefit of ecological restoration over ecological benefits (Johnson, et al., 2017; Cairns 2000; Smith, et al., 2014).

The common perception of the visual outcomes of restoration in streams and rivers is not aligned with what is best for fisheries and aquatic ecosystems. Research shows that people commonly view rivers without woody debris as being more ecologically productive than rivers with woody debris (Buijs 2009; Chin, et al. 2008; Piégay et al. 2005; Ruiz-Villanueva et al. 2018). Wood debris in rivers is an important part of a healthy aquatic ecosystem, however, in places where restoration management does not include putting woody debris into streams local residents suggest the removal of woody debris as a way to increase stream health. A dissonance of science and public communication may sometimes result from conflicting views in science that are perceived by public policymakers as conflicting perceptions and uncertainty around best-practice restoration design (Chin et al. 2008). We aim to dissolve some of the dissonances of environmental communication through a better understanding of landowner views so that education and outreach programs from the Scott River Watershed can target communication around community and place-specific goals.

The literature on sense of place and river restoration denotes a few common variables that sway the perception and attitudes of residents or landowners to the local landscape (Alam 2011, Buijs, 2009, Verbrugge, et al., 2018). Variables including proximity to a river, socioeconomic status, length of residency, depth of experience, and aesthetic experience factors will be analyzed in research on the Scott River landowners and are considered in the survey and study design. Willingness to participate is somewhat dependent on experiences and proximity or relationship with a water resource (Verbrugge, et al., 2018). Less financially or socially wealthy landowners may have reduced emotional attachment to a place within the context of environmental awareness and river restoration and landowners in the SRW may show reduced attachment to a place if they lack economic and social wealth or stability (Verbrugge, et al., 2018). Some research has shown residents can be supportive of river restoration without being concerned about the state of the river (Alam 2011). If landowners of the SRW do not see an environmental issue associated with the current state of the Scott River, they may still support river restoration.

Other variables that may predict or persuade attitudes towards river restoration are included in a study done evaluating the public perception of three separate restoration projects before and after restoration in the Netherlands (Buijs, 2009). This study identified three frames from which residents viewed the target river and river restoration. The attachment frame has to do with a sense of place, place attachment, and cultural heritage. The attractive nature frame is one where residents use perceived aesthetic values and natural aesthetic values to frame the river. Finally, the rurality frame is one where agricultural and rural values are considered a priority. The rurality frame may be a common theme from our research in the SRW. Rurality and attachment frames were found to be correlated with greater resistance to restoration and the sense of place attachment was found to be decreased after restoration (Buijs 2009). Our research will address landowners' perceptions of the SRW based on these three frames.

Protest groups in a Netherlands-based study framed restoration as detrimental and threatening while project managers framed restoration as a benefit to biological diversity and an enhancement to perceived aesthetic value (Bujis, 2009). In this study, safety concerns of flood management risks did not represent any major part of any framing reasoning for support or lack of support for the restoration proposal. Individuals identifying with the rurality and attachment frames require a voice in project conception and action, as well as the assurance of restoration outcomes and objectives from community peers rather than management authorities. Research on social perception and framing in the SRW will aid land managing bodies in determining the approach and social framing of any future restoration projects to ensure appropriate education and information is provided to community members and restoration participants. Focusing on the social and economic benefits of restoration will aid land managing bodies in addressing the issues participants care about and feel will impact their lives.

In addition to a social survey, this project will address land change in the SRW and create a virtual dashboard showcasing climate projections in the SRW. We researchers will use the National Land Cover Dataset to quantify land change in the Scott River Watershed and draw correlations to climate change projections. The climate adaptation virtual dashboard will include research and recommendations for adaptation strategies. We researchers will include an opportunity for residents to submit feedback for the virtual dashboard to further increase community engagement.

Change in upland land cover will be addressed and related to climate change projects, economic development of the region, and hydrology concerns. Concerns of wildfire’s effect on land change have arisen based on climate projections and projected increase in wildfire severity and frequency. Wildfire and snowpack interactions are complicated. Hydrologic response to

wildfire varies based on characteristics of the landscape and characteristics of the fire (Runyon, 2021). A major concern of post-fire burn areas is intense flooding of waterways causing further environmental destruction and putting humans at risk (Neary et al., 2011). In response to fire, generally speaking, evapotranspiration decreases due to less established vegetation, snowpack increases due to an increase in open clearings and fewer trees blocking snowfall, surface water runoff can increase leading to reduced groundwater infiltration, and water volume prediction becomes much more complicated (Maina & Siirila-Woodburn, 2019, p. 35).

A climate adaptation plan for Siskiyou County, California was created by the Model Forest Policy Program, the Cumberland River Compact, and the Mount Shasta Bioregional Ecology Center in 2014 (Cook et al., 2014). Recognizing the need for a climate adaptation strategy and assessment of vulnerabilities, the groups created a valuable resource detailing climate-related risks and adaptation opportunities. This resource provides information about local climate vulnerabilities, historic changes due to climate variation such as Mount Shasta glacial melt, and risk reduction strategies. While our adaptation assessment will be less detailed than the climate adaptation plan created by Siskiyou County organizations, the information will be tailored for a general audience. This project hopes to build on the current Siskiyou County climate communication structure.

SRW landowners may connect to environmental concerns such as climate change in a variety of ways, yet all landowners must be reached by climate communication. Engaging local residents in climate adaptation planning can be a valuable tool for strengthening the adaptive capacity of the SRW (Bartels et al., 2012). Engagement of climate adaptation discussions with residents is not a part of this research, but better understanding the diversity of concerns will benefit adaptation planning. Individual's degree of concern, opinion on the need for action, and perception of responsibility may affect how they respond to climate adaptation information (Buys, Miller, & an Megen, 2011). Through social surveys and the development of a virtual climate adaptation dashboard for the Scott River Watershed, more residents may be reached by climate communication efforts. Some residents' conceptualization of environmental issues will be informed through local climate change communication efforts.

Rural residents develop firsthand observations of climate change during their lifetime. Rural communities and individuals adapt to climate events independent of governmental regulation and climate policy (Hu & Amp; Chen, 2016). Recognizing this natural adaptation of rural citizens can aid the development of adaptation guides and strategies (Raymond & Robinson, 2013). Inviting adolescents to participate in the discussion of observed climate change during a senior residents' lifetime increases the perceived relevance of climate change

to the adolescent (Hu & amp; Chen, 2016). There is an advantage to discussing climate change and adaptation in a place-based framework. The goal of this climate adaptation virtual dashboard will provide easily accessible resources for SRW community members to observe projected climate change in tandem with observed local knowledge. Together, projections and place-based experience may result in increased concern and perceived relevance of climate change and its effects on rural communities in the SRW.

Early participation in the planning process and continued participation by supporters and groups with conflicting opinions can support the ecological, economic, social, and cultural community goals and uphold local perceptions and values following restoration work (Adams, et al., 2005; Buijs 2009; Durán, et al., 2018). A case study in Spain found community involvement to be closely linked to satisfaction of river restoration projects. Participatory inclusion of the public was welcomed and encouraged in this project at all phases including academic work, project design, execution, and the monitoring and assessment phase (Durán, et al., 2018). While it may seem public participation is a slowing and conflict-producing variable in restoration work, the benefit and conflict resolution gains that come from participation can be encouraged by including participation early on in the project planning process (Durán, et al., 2018). A project with public participation and public support can increase the success of project materialization (Adams, Perrow, and Carpenter 2005; Durán, Martínez, and Izquierdo 2018). Encouraging participation in research and problem-solving ecological issues in the SRW will contribute to individuals and organizations meeting social, economic, ecological, and community goals.

In this study, we analyze the social perceptions of restoration in the SRW. With strong leadership, committed partners, and further research the SRW can address its history of environmental degradation. We recognize the challenges and opportunities facing the restoration of aquatic systems in the SRW and aim to join a network of collaborators working on addressing these issues.

B. Research Questions

- How do landowners of the Scott River Watershed view restoration projects?
    - Do landowners see environmental issues as personal responsibility or a community responsibility or the responsibility of people at all?
    - What role do private landowners see themselves in environmental restoration?
    - How do landowners view the effect of landscape restoration on watershed productivity and community prosperity?

    - Do landowners hold value to the land similar to the way value is placed on community and family?

- How do high schoolers in Scott Valley CA view restoration projects?
    - Do high schoolers see environmental issues as personal responsibility or a community responsibility or the responsibility of people at all?
    - Do high school students see environmental issues as their responsibility or their parent's responsibility?
    - Do you hold value to the land similar to the way community/family?

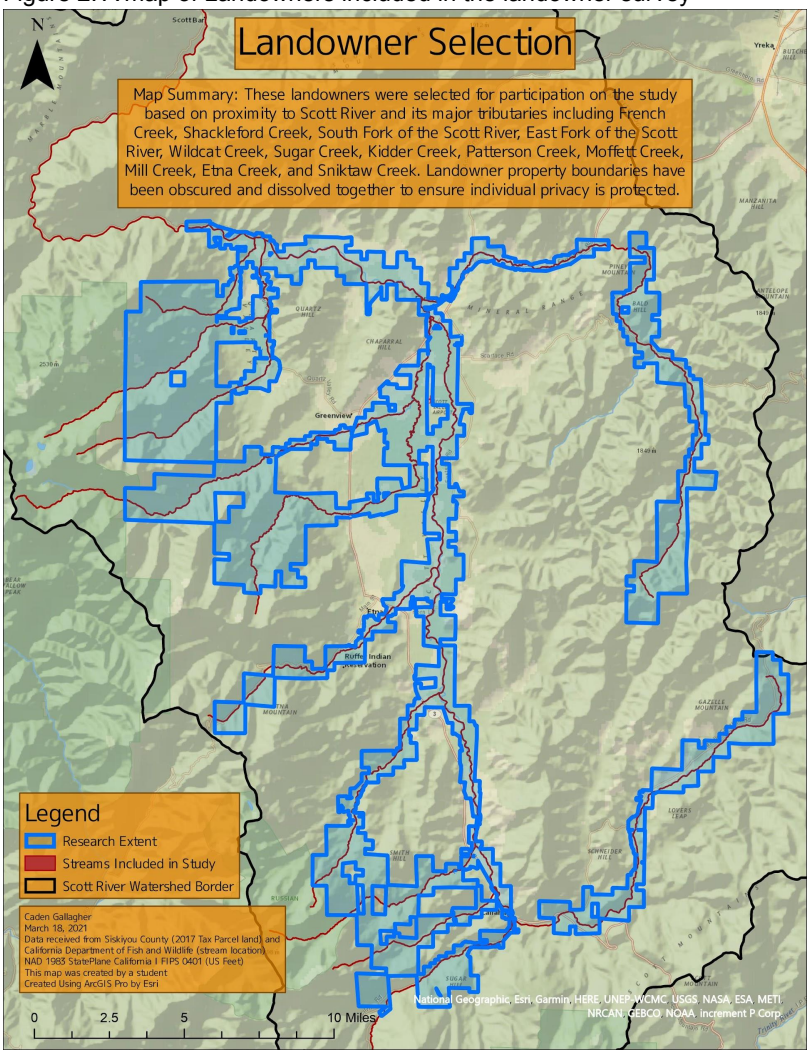
II. Methodology

A. Landowner and Student Survey

Research has been conducted by surveying two different groups of participants and comparing the data gathered from the two groups. These two groups are landowners and high school students living in the Scott River Watershed. The survey that was distributed to both groups is almost identical with minor wording changes to make questions relevant and appropriate respectively. A copy of the distributed surveys can be found in Appendix A and B. Researchers selected landowners and high school students as research populations, as these two groups represent accessible and appropriate ages to obtain comparable results.

Landowner addresses were obtained through tax records and publicly available data. Printed surveys (see Appendix A) were sent to landowners whose property borders or contains the Scott River and any of its major tributaries. A total of 335 landowners were contacted through mailed surveys for this study. The SRWC funded this portion of the project to pay for mail, packaging, and printing costs. Landowners were given over one month (April through May 2021) to respond to the survey and return the survey to researchers in order for their information to be used for the data analysis. Survey responses are

Figure 2: A map of Landowners included in the landowner survey



confidential and did not require participants to share their names. The returned surveys were identified by numbers coded with an address or plot of land to identify the views of the landowners in localized areas of the SRW. The georeferenced responses from the landowner surveys can be seen in Appendix H. The SRWC may contact these landowners in the future for further investigation towards participation in restoration efforts depending on survey responses. The landowners' survey responses were digitized and analyzed into theories and frames of the participants' views. This data was then compared to high school student data.

Students of Etna High School and Scott Valley High School have been contacted with permission from the Scott Valley Unified School District superintendent. Students received a specialized link to an anonymous survey (see Appendix B), that researchers generated on the online survey software, Qualtrics. The Qualtrics survey is nearly identical to the physical survey that has been sent to landowners. Researchers have no way to identify the names of the high school students that take the survey, as Qualtrics does not ask for specific identification information. Parents were contacted and were given the option to opt their students out of taking the survey. In total, there are around 190 students who were asked to participate in the survey and they were only allowed to take the survey once.

We received approval from the Institutional Review Board (IRB) to complete this project. When surveying humans, paperwork must be done and approved by the IRB. This is due to the youth human component and protects SOU and student researchers from liability. This research

has been approved by the IRB, meaning that student researchers are approved to discuss research conclusions and distribute the surveys.

B. Climate Adaptation Plan & Webapp

To better understand the need for restoration and the importance of it in the valley we have conducted a climate adaptation plan specifically for the SRW, CA. The full plan can be found in Appendix C of this report. To get at the root of many of the already established problems, past climate data was collected and compared with present climate conditions. The climate models created are based on RCP 4.5 and RCP 8.5. RCP. These models refer to the Representative Concentration Pathway, and are based on projections of the changing climate in different scenarios. RCP is based on carbon concentrations that will present climate change at an average of 4.5 watts per square meter globally, while RCP 8.5 is the same but for 8.5 watts per square meter. RCP 4.5 and RCP 8.5 models were used to predict climate conditions throughout the next century. This can be seen in the table below.

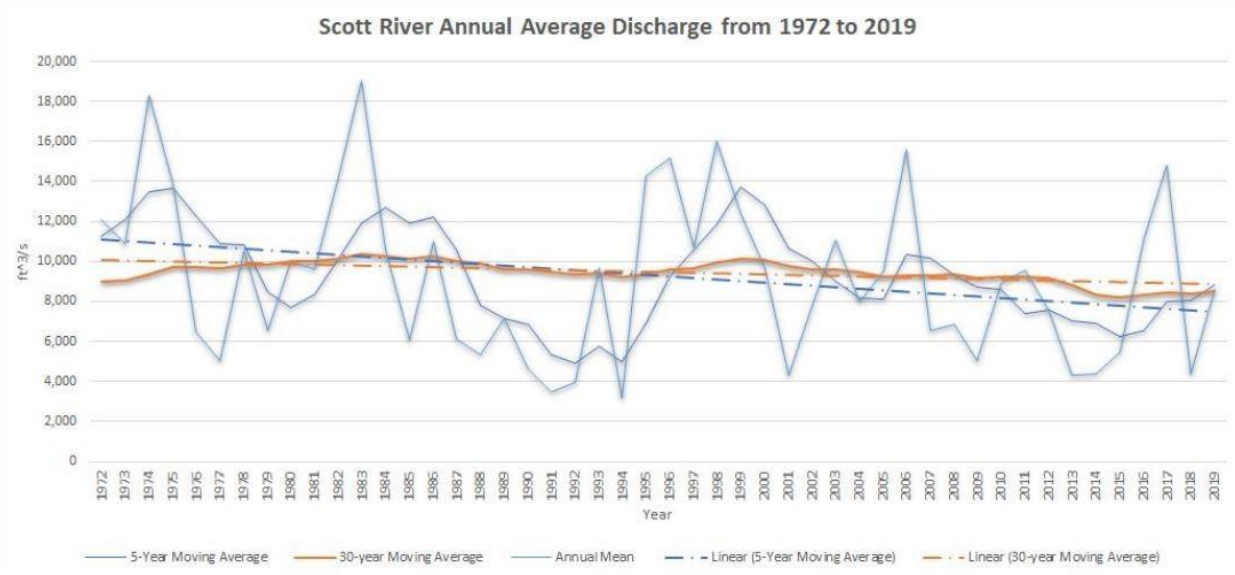
	Historical	2020-39 RCP 4.5	2020-39 RCP 8.5	2040-59 RCP 4.5	2040-59 RCP 8.5	2080-99 RCP 4.5	2080-99 RCP 8.5
Annual Temp.	55°F	52°F	55°F	55°F	55°F	55°F	58°F
Winter	36°F	38°F	38°F	38°F	38°F	42°F	44°F
Summer	69°F	72°F	72°F	72°F	72°F	72°F	80°F
Days < 32°F	110 Days	70 Days	70 Days	70 Days	70 Days	80 Days	80 Days
Days > 95°F	30 Days	30 Days	50 Days	50 Days	50 Days	70 Days	90 Days

Table 1. Climate projections for average air temperature across the state of California, Siskiyou County according to the IPCC AR5 report. Downscaled data are taken from the Climate Impact Lab (http://www.impactlab.org/)

From the data above and comparing the historical values with the results of the RCP 4.5 and RCP 8.5 models it was determined that the three main areas of concern in terms of climate change are an increase in wildfire risk, risks of isolating the local economy through lack of economic diversification, and changes in the hydrology of the SRW. To combat these predicted changes adaptation strategies have been formulated. For the increasing wildfire risk, it has been determined that the re-introduction of cultural burning or prescribed burning would help reduce

the fuel load and protect against future periods of drought. Community members and local agencies should work together in creating defensible space around all structures. In regards to the local economy, it has been determined that investing in climate adaptation strategies and diversifying the driving focus away from timber harvest, tourism, and agriculture would help against economic instability driven by environmental symptoms of climate change. Many aspects of major local economic drivers are predicted to be highly impacted by climate change in short and long term projections. The hydrology and much of the flora and fauna of the SRW are also vulnerable to climate change. To better prepare and protect the overall hydrologic systems it has been found that introducing beaver dam analogs and investing in riparian restoration will have positive impacts on ecological communities and groundwater recharge. The need and importance of restoration in the SRW requires community support and participation from landowners with riparian habitat.

Figure 3: Scott River water gauge annual discharge from 1972 to 2019



In the SRW, water discharge has been decreasing (see figure three) while climate models show an increasing trend in precipitation. This disparity may be due to an increase in evapotranspiration from increased temperatures, reduced forest cover and riparian habitats, reduced groundwater recharge due to burning scars, and an overall reduction in forested lands. Based on land cover change seen in figures four and in Appendix D, wildfire burn scars and timber harvest plots may affect landscape characteristics enough to partially explain a reduction in water discharge. Any factor contributing to groundwater reduction in the Scott River Watershed should be assessed further by local land management agencies to assess future

climatological implications of wildfire interactions with groundwater and perennial water availability.

C. Climate Communication Virtual Dashboard

A climate adaptation focused virtual dashboard will support climate communication and climate literacy in the SRW. The State of California has analyzed over 30 climate models and determined the four most geographically reliable and representative models to use in assessing climate projection. One model was selected for representing a warm/dry future, another for cool/wet, one representing an average of the models, and a final one which was most unlike the other three. This project used the average model "CanESM2" to visualize localized climate projections.

Annual precipitation, average annual temperature maximum, and average annual temperature minimum data were selected for visualization on the virtual dashboard. The original raster data showed a single year ranging from 2006 through 2100. For this project, the data was sorted into decades and averaged by decade to make 10-year climate summaries for each variable. Then the data was sorted into early, mid, and late-century climate frames of 29 years each from 2010 to 2099. Climate frame values were subtracted from each other to create the units of change seen in climate projections for each of the three variables for a high emission scenario (RCP 8.5) and a moderate emission scenario (RCP 4.5). The link to the Web App can be found in Appendix E.

D. Land Change

Land change data has been analysed and summarized below. The summary statistics for land change in the SRW is seen below in two charts. The final maps of Land Change in the SRW can be found In Appendix D. See Appendix G for more information on land change by acreage rather than percentage of total land area.The land change maps provide a visual representation of data represented in figures four and five.

Figure 4: Land Cover change from 2001 to 2016 showing interactions of evergreen shrub/scrub, and herbaceous land cover by percentage of total land in the Scott River Watershed.

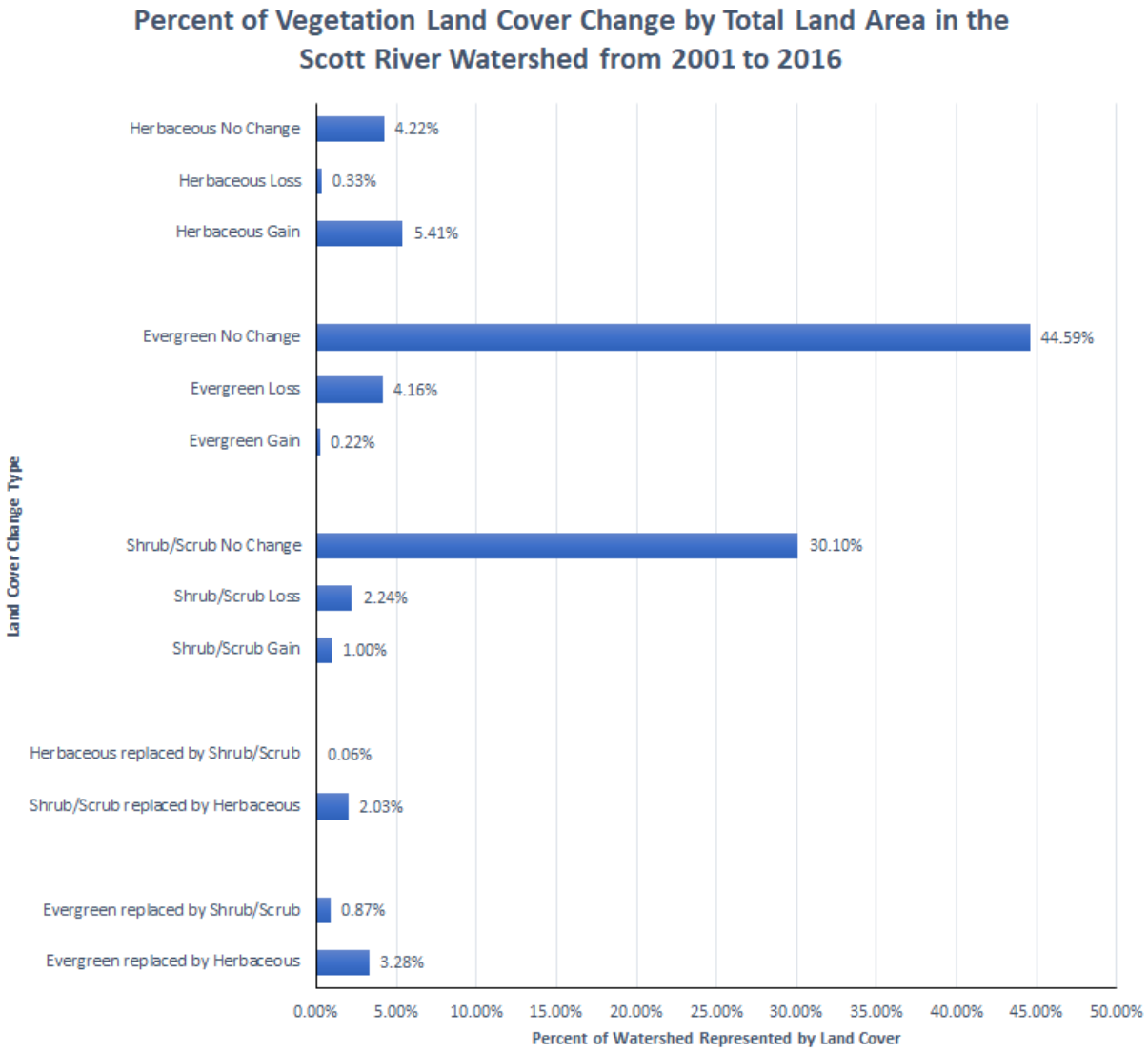


Figure four (above) details major vegetation land cover changes in the Scott River Watershed from the years 2001 to 2016. These changes are notable for how they represent a major shift from evergreen forest land cover to herbaceous and shrub/scrub land cover. Observing the maps found in Appendix D shows fire scars and timber harvest being major contributors to the loss of evergreen land cover. The general shift from evergreen forest to shrub/scrub and herbaceous land cover will likely continue based on climate projections and changing characteristics of ecological communities in the SRW.

Figure 5: Land Cover change from 2001 to 2016 showing interactions of cultivated crops, hay/pasture, barren, and woody and emergent herbaceous wetlands land by percentage of total land in the Scott River Watershed.

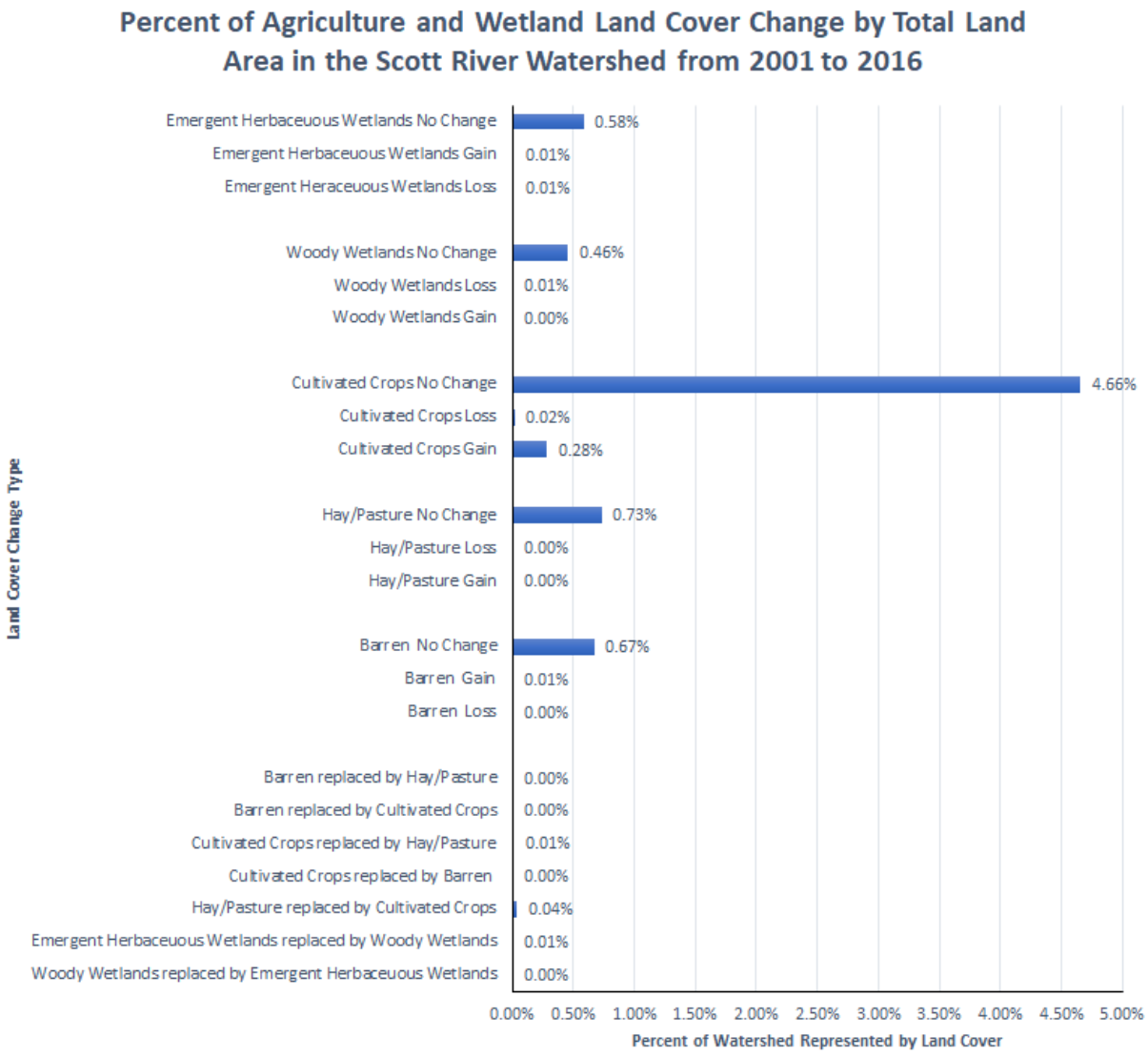


Figure five (above) details woody and emergent herbaceous wetlands, agricultural, and barren land cover changes in the Scott River Watershed from the years 2001 to 2016. Notable changes shown above include over 1,400 additional acres of cultivated crop land in the SRW. Hay/pasture saw a net increase of 64 acres from 2001 to 2016. Agricultural land characteristics suggest a change towards the development of new crop-land and the conversion of hay/pasture crops land to cultivated crop land at a greater frequency than hay/pasture crops being converted to cultivated crops. Zero acres were observed changing from barren land to agriculture suggesting barren land in the flat primarily agricultural lands of the valley floor were not restored to agricultural land or another land-type. The net loss of 10 acres of emergent herbaceous

wetlands and 21 acres of woody wetlands is of great concern considering water scarcity implications of other land use changes and climate change projections. During the same time, 3 acres of land were observed changing from cultivated crop use to barren land.

III. Results and Discussion

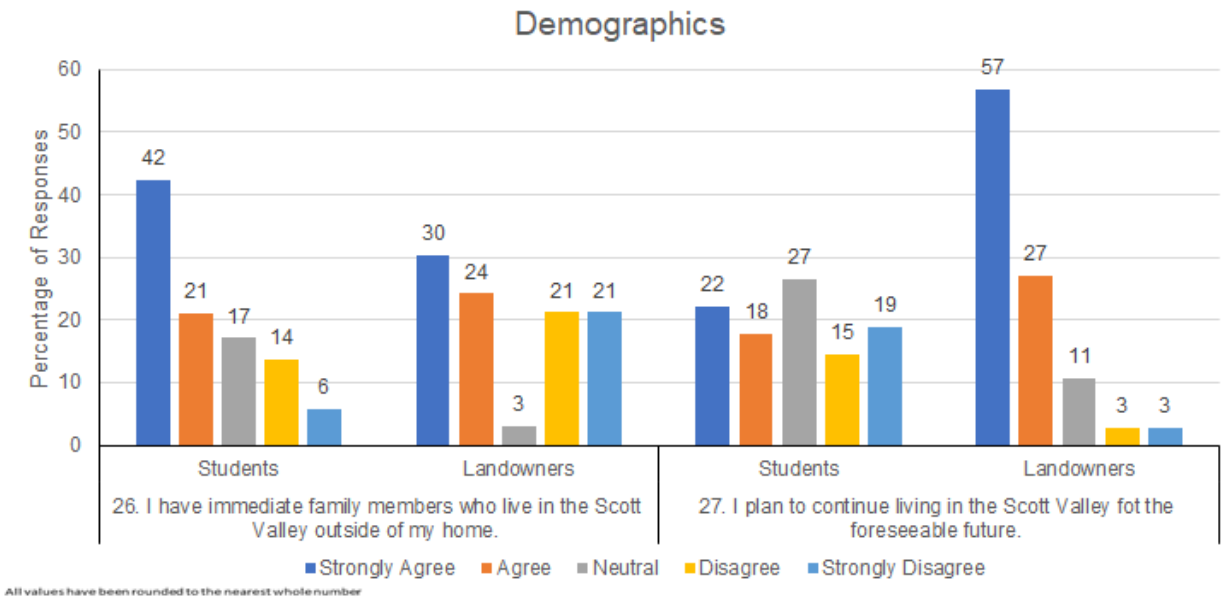
All survey data was processed using the data analysis software, SPSS Statistics. For the purpose of data processing and analysis, researchers received 130 student surveys and 30 landowner surveys. Qualtrics provides a digitized table of the students' responses. To ensure the landowner responses were analyzed in the same way, responses were entered by hand in the same format as the student's. Due to the smaller sample size of landowners, no specific tests to compare the data were able to be used to accurately represent the population. Using SPSS, simple frequencies and combined question frequencies were done. All surveys received were analyzed for the purposes of future restoration work within the SRW, for the purposes of the SRWC. For the purpose of analyses, survey questions were put into categories by student researchers, based on the topic that they were addressing. The different categories of questions are demographics, value and attachment, restoration, land use management, responsibility and private property rights.

A. Demographics

To understand the population that we surveyed we asked some simple questions regarding their time in the valley, immediate family and if they plan to live in the valley for the foreseeable future, questions 30, 26 and 27 respectively. A majority (56.9%) of student respondents stated that they have lived in Scott Valley for 15, 16, 17 or 18 years, this corresponds with the common age range of students in high school. From this information we can make the assumption that many students have lived in Scott Valley for most of their lives. Due to the small sample size of landowner respondents there wasn't a most frequent year that respondents have lived in the valley. The range of responses was from 5 years all the way to 86 years. However, a majority (50.0) of the respondents stated that they have lived in the valley for 43 years or less. Of the students and landowners surveyed a majority (63.4, 54.5) of both groups agreed to some degree that they have immediate family in Scott Valley outside of their home. Furthermore, about 40% (40.2) of student respondents agreed to some degree that they planned to live in the Scott Valley for the foreseeable future, with only about 33% (33.3) of students indicating that they disagree to some extent. Conversely, of the landowner respondents a majority (83.8) indicated that they agreed to some degree that they planned to live in the Scott Valley for the foreseeable future, with only about 6% (5.6) stating they disagreed to some extent.

Given this information it can be concluded that a majority of landowner respondents will continue to be in the valley and that any restoration efforts made by SRW will impact and interact with the respondents. Building off of this it seems likely that many of the respondents in both groups will continue to have some connection with the valley, as a majority of respondents have immediate family outside their homes living in the Scott Valley.

Figure 6. Demographic questions survey percentage of respondents.



B. Value and Attachment

To continue to understand the potential connection that respondents have with the Scott Valley we have divided questions into groups related to value and attachment. Questions related to value asked about close family, community, and land (questions 17, 18 and 19 respectively). A majority of respondents in both groups agreed to some degree that they value their close family (students 89.8%, landowners 100.0%). A majority of respondents in both groups agreed to some degree that they value their community (students 81.6%, landowners 100.0%). A majority of respondents in both groups agreed to some degree that they value the land they live on (students 88.8%, landowners 100.0%). A majority of respondents agreed to some degree that they value their close family, community and the land that they live on. Questions 20, 21 and 22 ask about attachment to the Scott Valley based on visual and aesthetic beauty, family and community, and utility and financial value. A majority of student (59.3) and landowner (94.6) respondents inundated that they agree to some degree that they are attached to the Scott Valley for its visual and aesthetic beauty. About 49% (48.7) of student respondents indicated that they feel attached to the Scott Valley for its association with family and community, compared to a

majority of landowner respondents (83.3). Conversely less than a majority of student (44.0%) and landowner (47.2%) respondents indicated that they feel attached to Scott Valley for its utility and financial value. From these results it appears that respondents feel attached to the Scott Valley for its visual and aesthetic beauty along with family and community rather than its utility and financial value.

Figure 7. Value questions survey percentage of respondents.

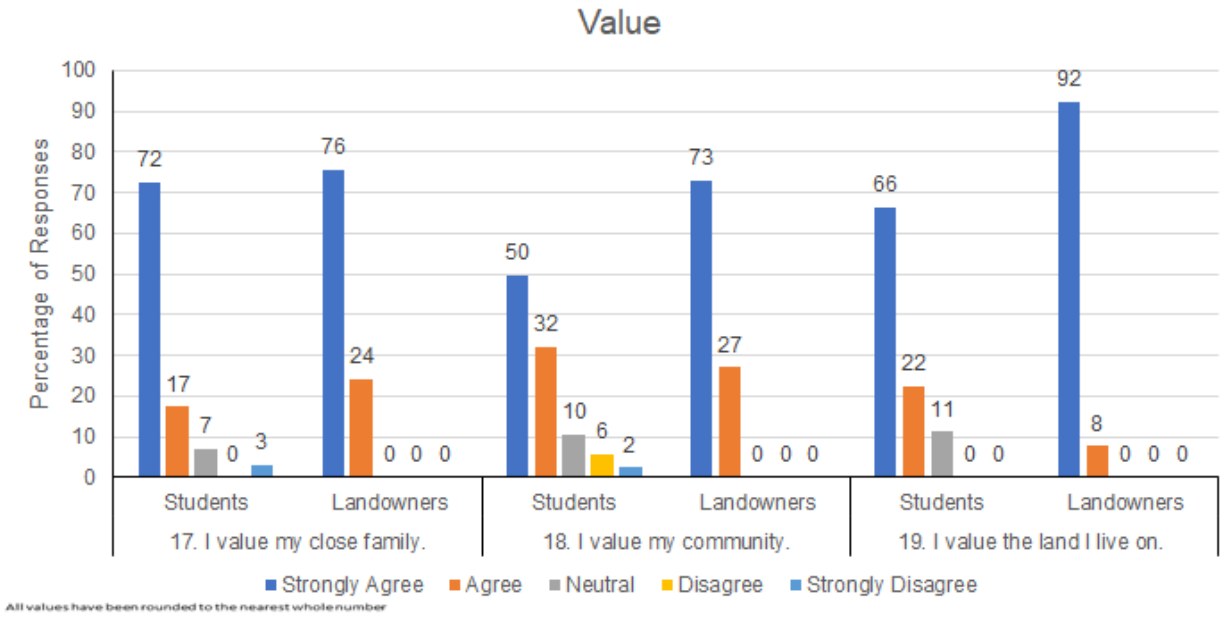
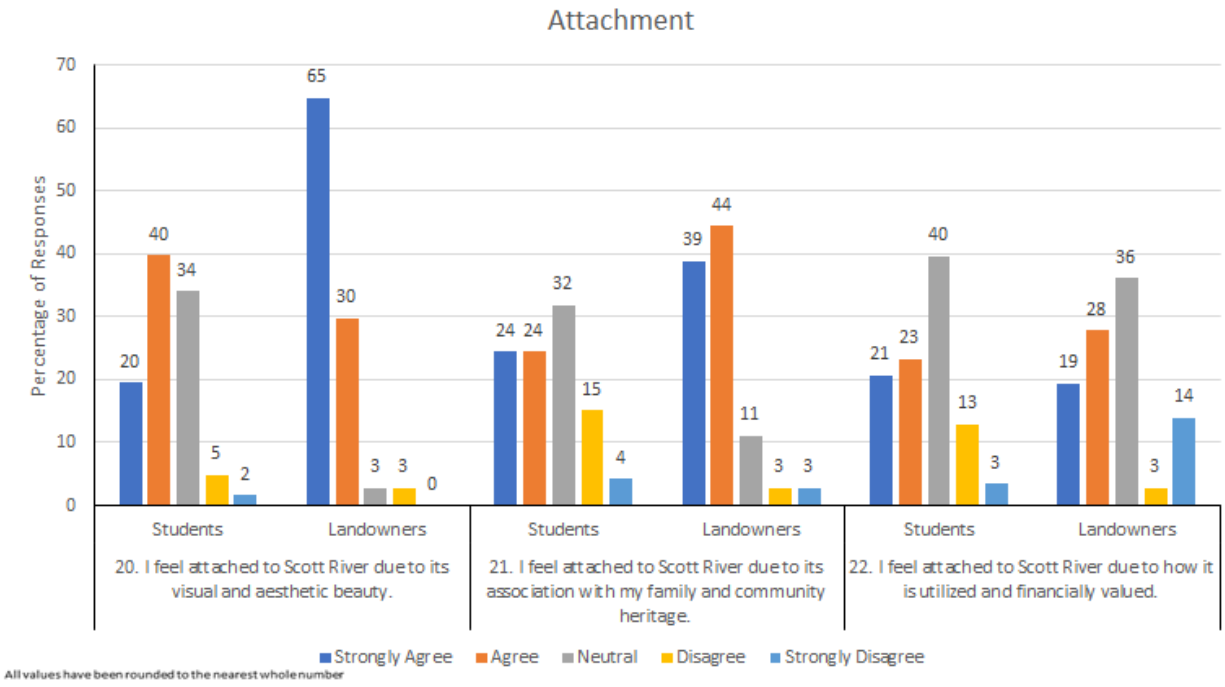


Figure 8. Attachment questions survey percentage of respondents.



C. Restoration Support

Question 5 relates to the support of restoration efforts directed by external agencies, in this case SRWC. From running a simple frequency nearly 38% (38.1) of students agree to some degree that they support restoration efforts directed by external agencies, compared to 60% of landowners. These results to question 5 can be compared with other questions related to supporting restoration to better understand the restoration perceptions. Question 6, regards to supporting restoration on the respondents property. From a simple frequency, about 42% (41.6) of students agree to some degree that they support restoration on their property compared to about 67% (66.7) of landowners. Combining the two questions it can be seen that about 22% (22.2) of students support restoration efforts directed by external agencies and support restoration on their property with an additional 20% conditional support, compared to about 16% (16.1) of landowners fully supporting and an additional roughly 10% (9.7) having conditional support. In other words the support of restoration directed by external agencies drops when private property comes into play.

Furthermore, comparing the results of question 5 to question 7, which addresses the necessity of restoration efforts in the Scott Valley, shows if there is support for question 5 along with a perception of necessity. From a simple frequency, 43% of students agree to some degree that restoration efforts are necessary compared to 85% of landowners agreeing to some degree. Combining the two questions it can be seen that about 21% (21.1) of students support restoration efforts directed by external agencies along with a feeling of necessity with an additional roughly 11% (10.5) conditional support, compared to about 6% (6.3) full support by landowners and an additional roughly 19% (18.8) conditional support. To restate there seems to be a trend of disconnect in support for restoration efforts directed by external agencies and feeling that restoration is necessary in Scott Valley.

The last of this set of analysis, compares question 5 to question 8, which addresses external agency restoration efforts leading to financial prosperity. From a simple frequency it can be seen that about 23% (22.7) of students agree to some degree that external agency restoration efforts lead to financial prosperity in Scott Valley, compared to about 48% (47.5) of landowners agreeing to some degree. Combining the two questions is can be seen that 40% of students support restoration efforts directed by external agencies and agree that the efforts will lead to financial prosperity with an additional roughly 11% (11.4) conditional support, compared to roughly 21% (20.8) full support from landowners with an additional roughly 8% (8.3) conditional support. In other words there seems to be a trend that students that support restoration efforts directed by external agencies are more likely to make a connection that these

efforts will lead to financial prosperity compared to landowners who support restoration efforts directed by external agencies. Figure of restoration responses can be found in Appendix I.

D. Natural Resource Management

To get a better understanding of the perception of students and landowners on the role of human intervention in resource management an analysis of questions 9, 10, 11, 12, 14 and 15 has been conducted. Question 9 addresses if humans should play a role in resource management in the first place. From a simple frequency about 67% (67.2) of students agree to some degree that humans should play a role in resource management compared to about 92% (92.3) of landowners. In both groups a majority of respondents agree to some degree that humans should play a role in resource management. Building off of these results and analyzing questions 10-12, a majority of students agree to some degree that fishing, timber harvesting, and hunting are all important resource management activities with results of 79.8%, 76%, 79.7% respectively. Landowners share similar perceptions with a majority agreeing to some degree that these activities are important for resource management with results of 79.5%, 92.3% and 82.5% respectively. Lastly, looking at the response frequency of questions 14 and 15, there is a trend that landowners feel more responsible for resource management locally and globally than students. About 73% (72.5) of landowner respondents feel that it is their responsibility to help solve natural resource problems in Scott Valley compared to roughly 38% (37.6) of student respondents. Furthermore, about 53% (52.5) of landowner respondents feel that it is their responsibility to help solve natural resource problems globally, compared to about 27% (26.7) of student respondents. In both regional and global scenarios a majority of landowners feel responsible for natural resource management problems, where students do not share the same perception. To better understand why this is, we will analyze questions regarding who the responsibility should fall on. Figure of natural resource management questions can be found in Appendix J.

E. Who is Responsible?

Questions 28 and 29 address the role of industry, government, environmental non-profits, and individuals when it comes to ensuring we have a healthy environment.

Figure 9: Question 28 from student and landowner survey; visualization of responses.

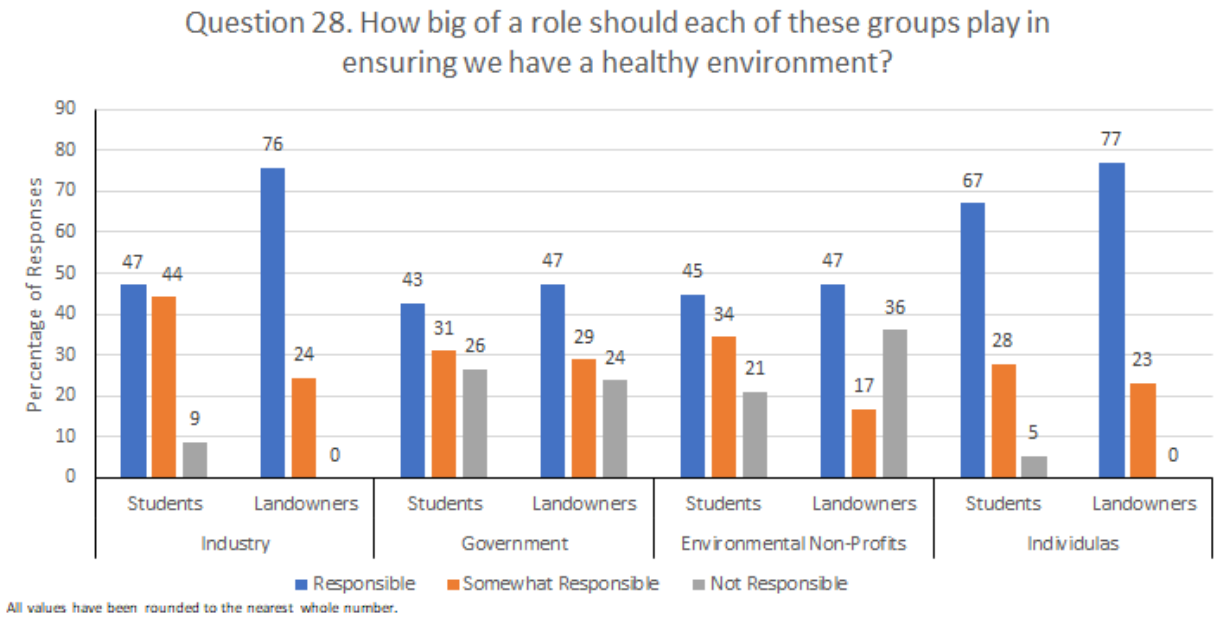
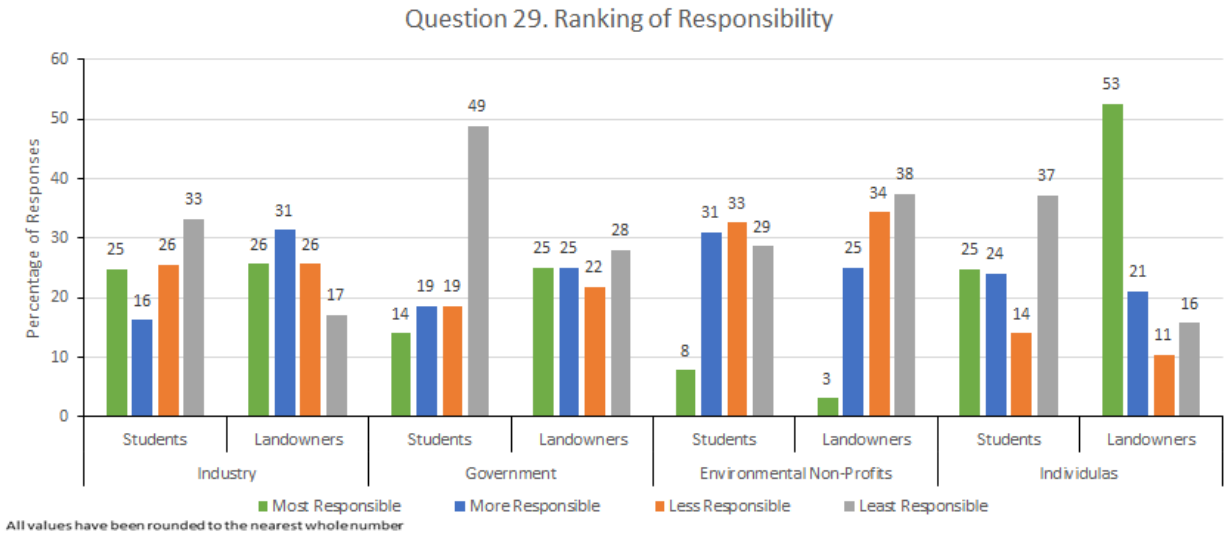


Figure nine (above) breaks down the percentage of responses for question 28 from students and landowners for each of the 4 groups. It is notable that about 77% (76.9) of landowner respondents stated that individuals are responsible in some form compared to 67% of student respondents. While this isn't the same distribution as above in question 14, it follows the trend of more landowners taking on individual responsibility for the environment compared to students. It is important to note that questions 14 and 28 are not identical and could be interpreted in different ways, causing the difference in responses. It is also notable that roughly 76% (75.7) of landowners find industry to be responsible compared to only about 47% (47.1) of students. Response frequency for government and environmental non-profits being responsible in some form are very similar, with about 47% (47.4, 47.2) for both from landowners and about 43% (42.7) and 45% (44.8) respectively from students. From these results, landowners appear to see individuals and industry to be most responsible for the health of Scott Valley whereas students see individuals as most responsible and the other three groups nearly equal in percentages.

Figure 10: Question 29 from student and landowner survey; visualization of responses



Question 29 asked respondents to rank the 4 groups from most responsible to least responsible for the health of the environment. Figure ten (above) shows the results from this question. It is notable that a majority (52.6) of landowner respondents see individuals as most responsible. It is also notable that a near majority (48.8) of students see the government as least responsible. It is also noteworthy that both students and landowners find environmental non-profits to be more responsible or less, with very few saying they are most responsible.

F. Property Rights

To understand the perception that respondents have around property rights, 4 questions have been grouped together, the questions are 1, 2, 3, 13, and 24. These questions are very specific about private property rights to see whether or not landowners believe that a private property owner can do what they please with their own land. A majority of students (53.2%) agreed that individuals should be allowed to use private land for any purpose without government regulation, while a majority (60%) of landowners disagreed or strongly disagreed with this same statement (question 1). On the flip side of this, question 3, regarding whether the government should be able to regulate private land to conserve natural resources got a very different answer. A majority (55%) of landowners and 35.2% of students disagreed with this statement. Question 2 builds off of this and asks respondents about their perception of wetlands being used for agriculture or industrial uses. The two groups have polar perceptions regarding this topic. A majority of students (68.0%) agreed to some degree that landowners should be allowed to use wetlands for agriculture or industrial purposes, compared to a majority of landowners (52.6%) that disagrees to some extent with this statement. Lastly, looking at question 13, which asks about the protection of certain species on private property, a majority of

students (51.2%) and landowners (53.8) agree to some degree that species' habitat should be protected on private land. Interestingly enough, in question 24, when asked if respondents want beavers on their property, about 44% (43.5%) of students were neutral about the topic and a majority of landowners (58.3%) disagreed to some extent meaning that they do want beavers on their property. From these results there is a trend that landowners are more cautious about private land use without the regulation of government, whereas students feel more comfortable with private property being used without the regulation of government. This may mean there is an opportunity for the SRWC to educate local students on how the government currently regulates private property, and what has taken place in the past with little management.

Figure 11. Property rights questions survey percentage of respondents.

IV. Conclusion

The aquatic ecosystem of the Scott River Valley has been impacted due to human development. Areas specific to the Scott Valley, such as the Scott River Watershed and specifically Moffett Creek Watershed, have been significantly impacted by human development. Moffett Creek Watershed has lost perennial flows due to groundwater depletion, causing the loss of riparian vegetation, habitat, and an increase in bank erosion, along with other impacts. The results of the included Climate Adaptation Plan justify the need for restoration efforts more than ever. Under both RCP 4.5 and RCP 8.5 models for the region, winters are going to become warmer and wetter for a shorter period of time, with longer, hot and dry summers. A change in

average seasonal temperature, as predicted for the Scott Valley, will have immense impacts on the local hydrology, impacting the entire environment.

The Scott River Watershed Council and other groups have been working for years to restore the already damaged hydraulic systems throughout the watershed, specifically with beaver dam analogs. However, they need the support of the local community to make the progress that is needed to sustain the environment without more loss. From the review of other researchers' work around the world, it has been found that community involvement in restoration efforts has significant impacts on the success of restoration projects.

This study faces limitations regarding landowner response uncertainties and a small sample size. It is important to keep in mind that 130 students were surveyed and 40 landowner surveys have been completed at the time of this report. Landowners who own property near streams and rivers may view restoration needs differently than landowners who own land farther from riparian habitat. Landowners who feel strongly about aquatic habitat restoration may have been more inclined to respond to the mail survey than landowners who do not feel a strong need for restoration in the SRW. Much of the Scott River Watershed is private property and further research is needed to understand the full scope of community views and levels of support for restoration.

From surveying local high school students and landowners specific and significant trends have been found. Both groups demonstrated a feeling of attachment to the Scott Valley, and it seems that there is a consensus that landowners and students want to protect the land that they live on. Data obtained from this analysis can now be used to gauge how the Scott River Watershed Council should be addressing restoration when it comes to public involvement and education. This knowledge is essential to carrying out potential restoration projects that have a positive impact on the SRW as a social and ecological community.

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VI. Appendices

Appendix A: Landowner Survey

See attached document

Appendix B: Student Survey

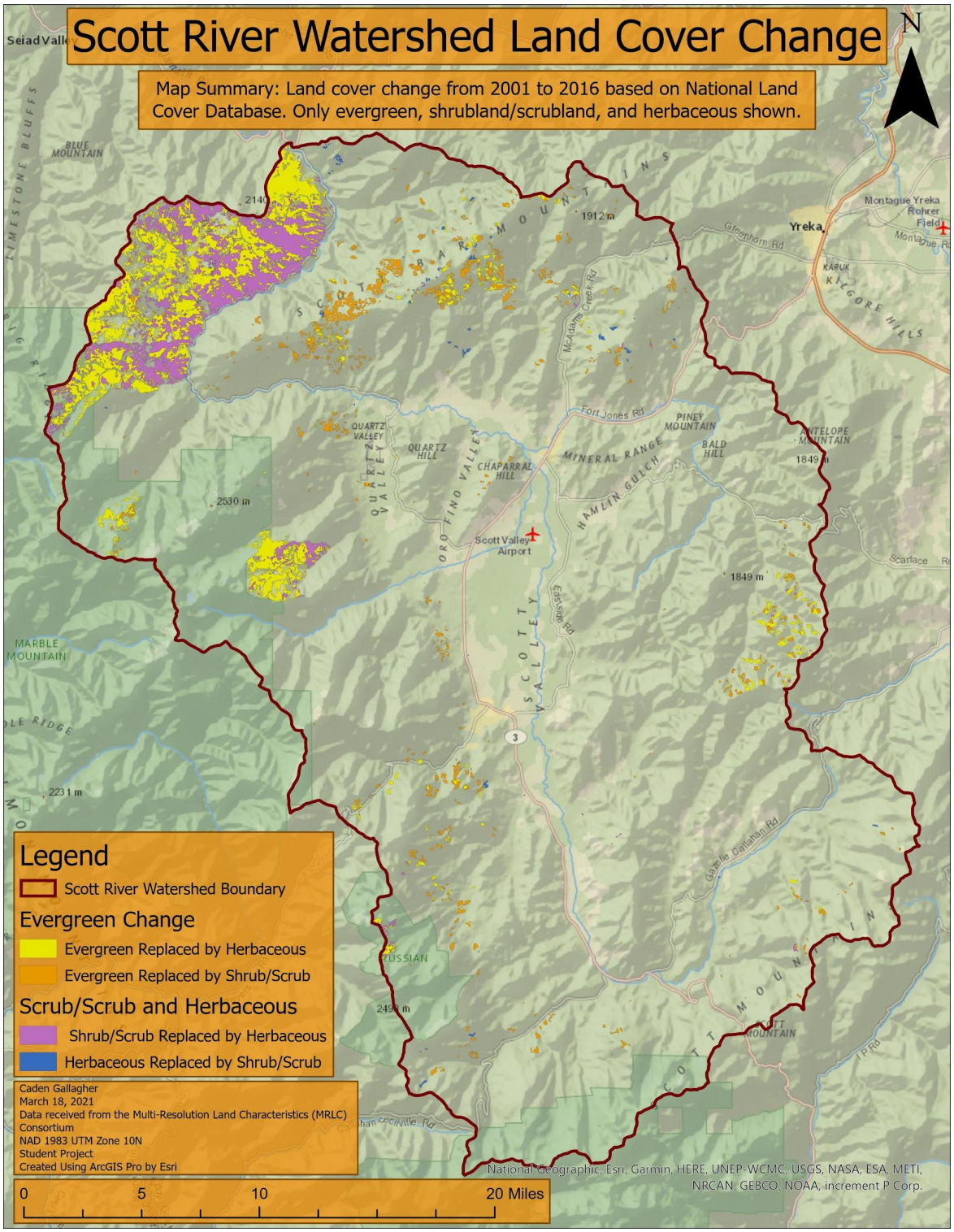
See attached document

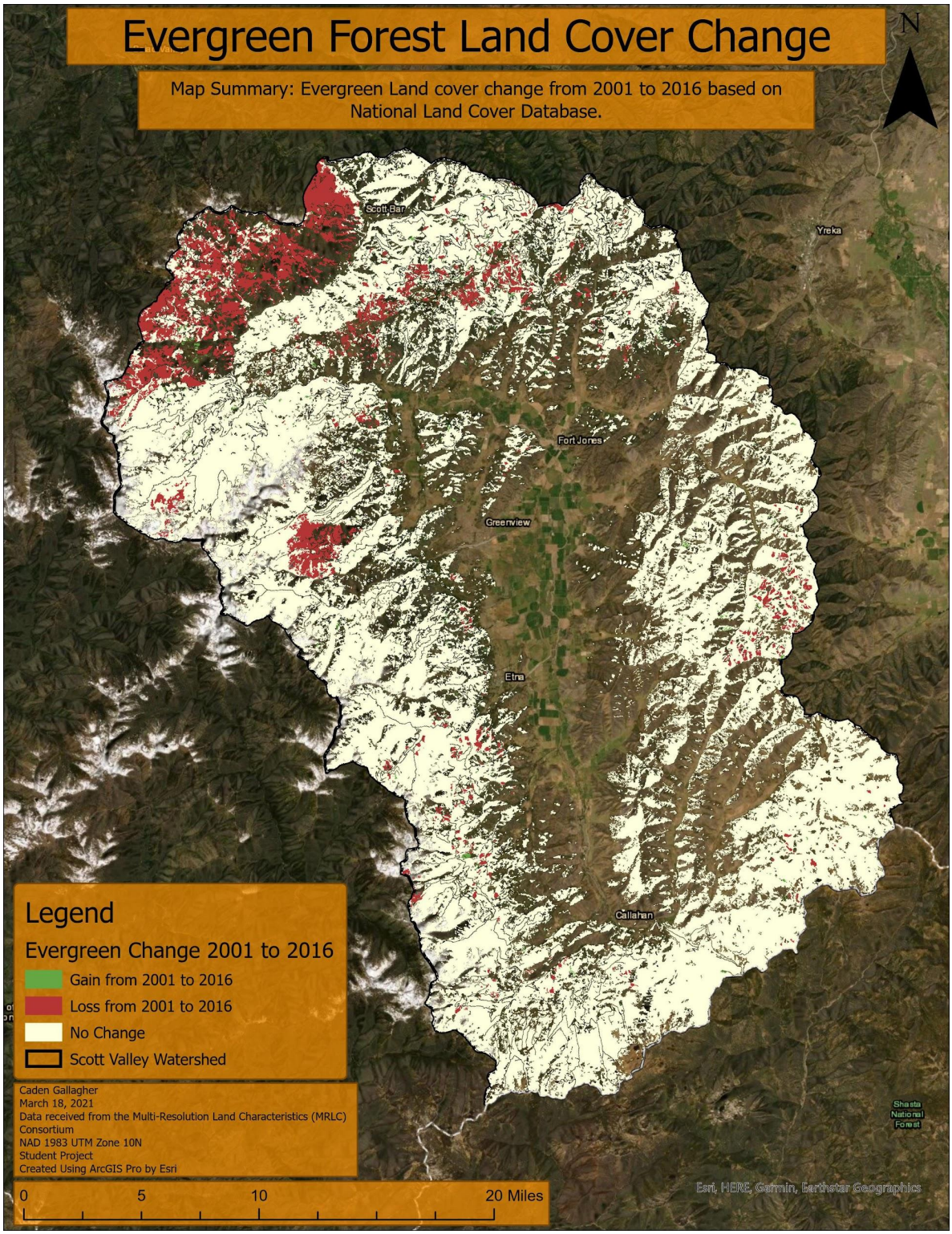
Appendix C: Climate Adaptation Plan

See attached document

Appendix D: Land Change Maps

(please see additional attached documents for a PDF version of the land change maps)




Evergreen Forest Land Cover Change
Map Summary: Evergreen Land cover change from 2001 to 2016 based on National Land Cover Database.
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Scott Bar
Yreka
Fort Jones
Greenview
Etna
Callahan
Shasta National Forest
Legend
Evergreen Change 2001 to 2016
Gain from 2001 to 2016
Loss from 2001 to 2016
No Change
Scott Valley Watershed
Caden Gallagher
March 18, 2021
Data received from the Multi-Resolution Land Characteristics (MRLC) Consortium
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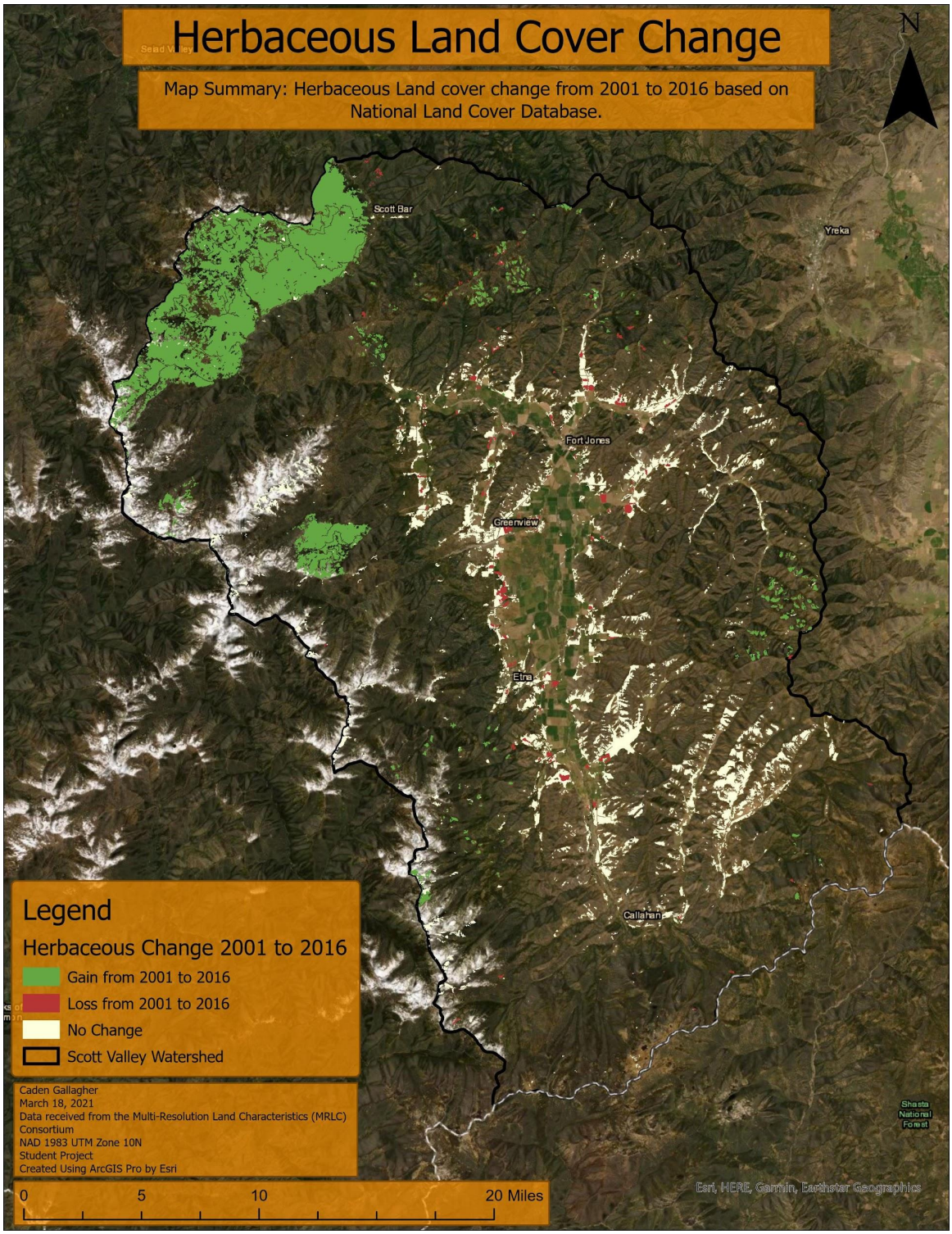
Herbaceous Land Cover Change
Map Summary: Herbaceous Land cover change from 2001 to 2016 based on National Land Cover Database.
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Scott Bar
Yreka
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Greenview
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Herbaceous Change 2001 to 2016
Gain from 2001 to 2016
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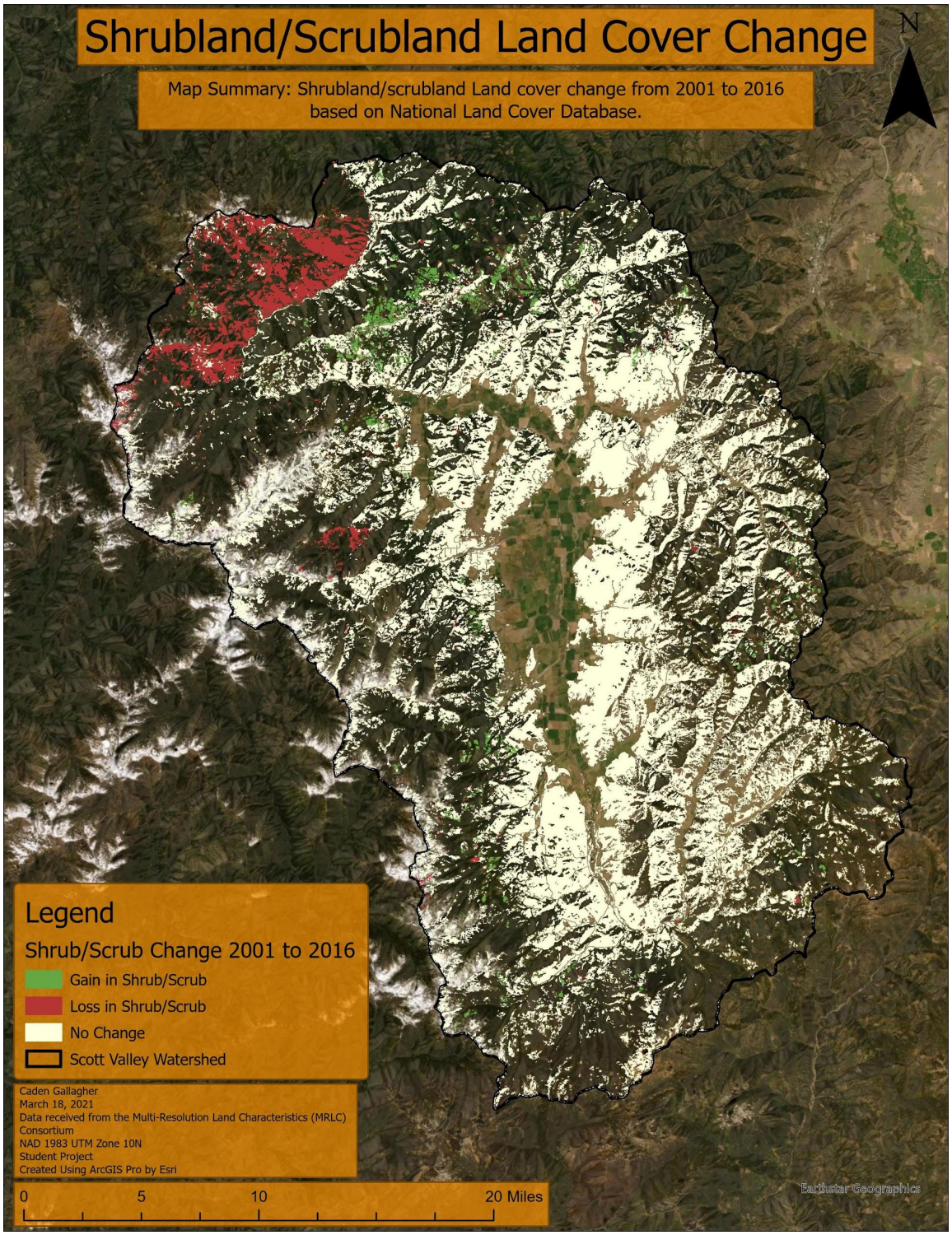
Shrubland/Scrubland Land Cover Change
Map Summary: Shrubland/scrubland Land cover change from 2001 to 2016 based on National Land Cover Database.
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Shrub/Scrub Change 2001 to 2016
Gain in Shrub/Scrub
Loss in Shrub/Scrub
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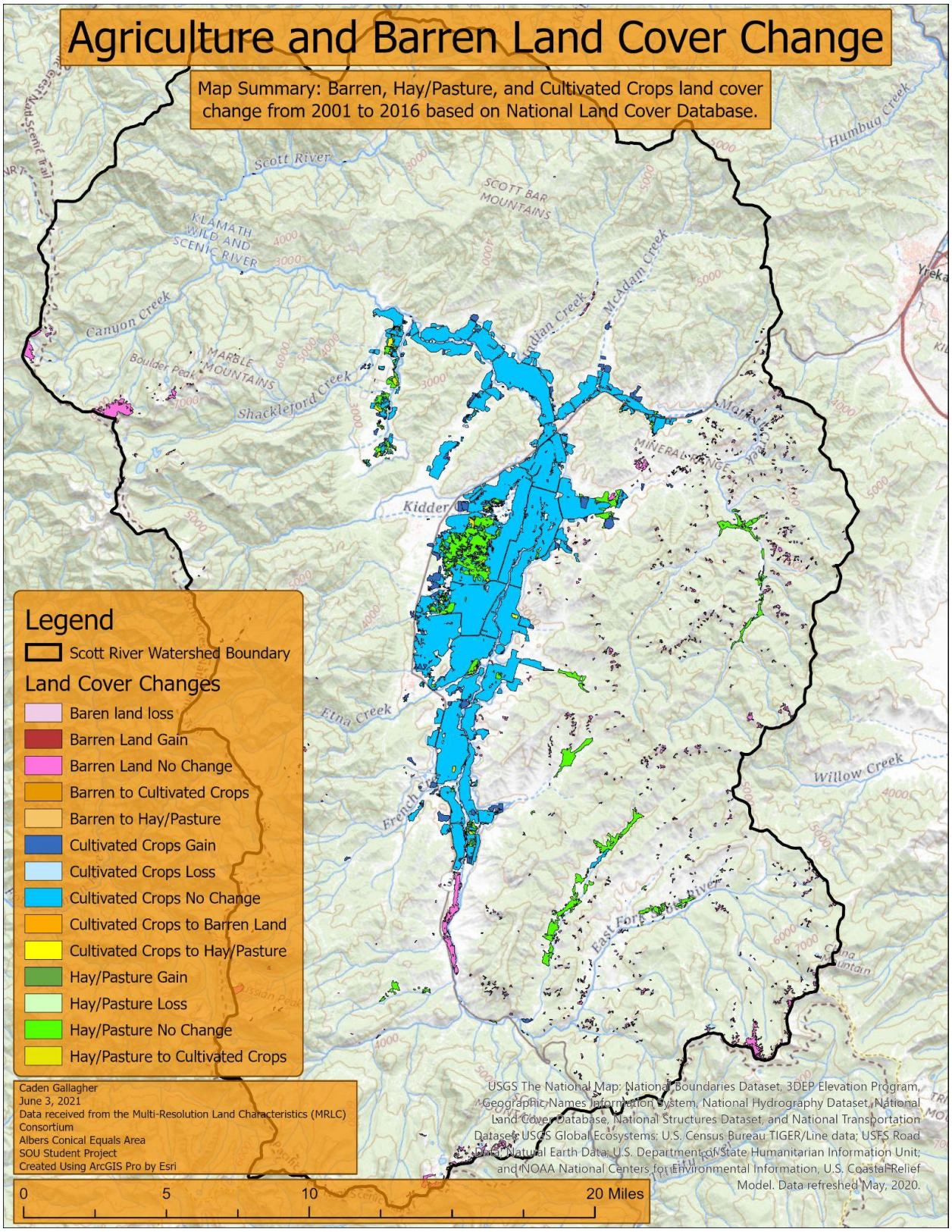
Agriculture and Barren Land Cover Change
Map Summary: Barren, Hay/Pasture, and Cultivated Crops land cover change from 2001 to 2016 based on National Land Cover Database.
Legend
Scott River Watershed Boundary
Land Cover Changes
Baren land loss
Barren Land Gain
Barren Land No Change
Barren to Cultivated Crops
Barren to Hay/Pasture
Cultivated Crops Gain
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Cultivated Crops No Change
Cultivated Crops to Barren Land
Cultivated Crops to Hay/Pasture
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Hay/Pasture Loss
Hay/Pasture No Change
Hay/Pasture to Cultivated Crops
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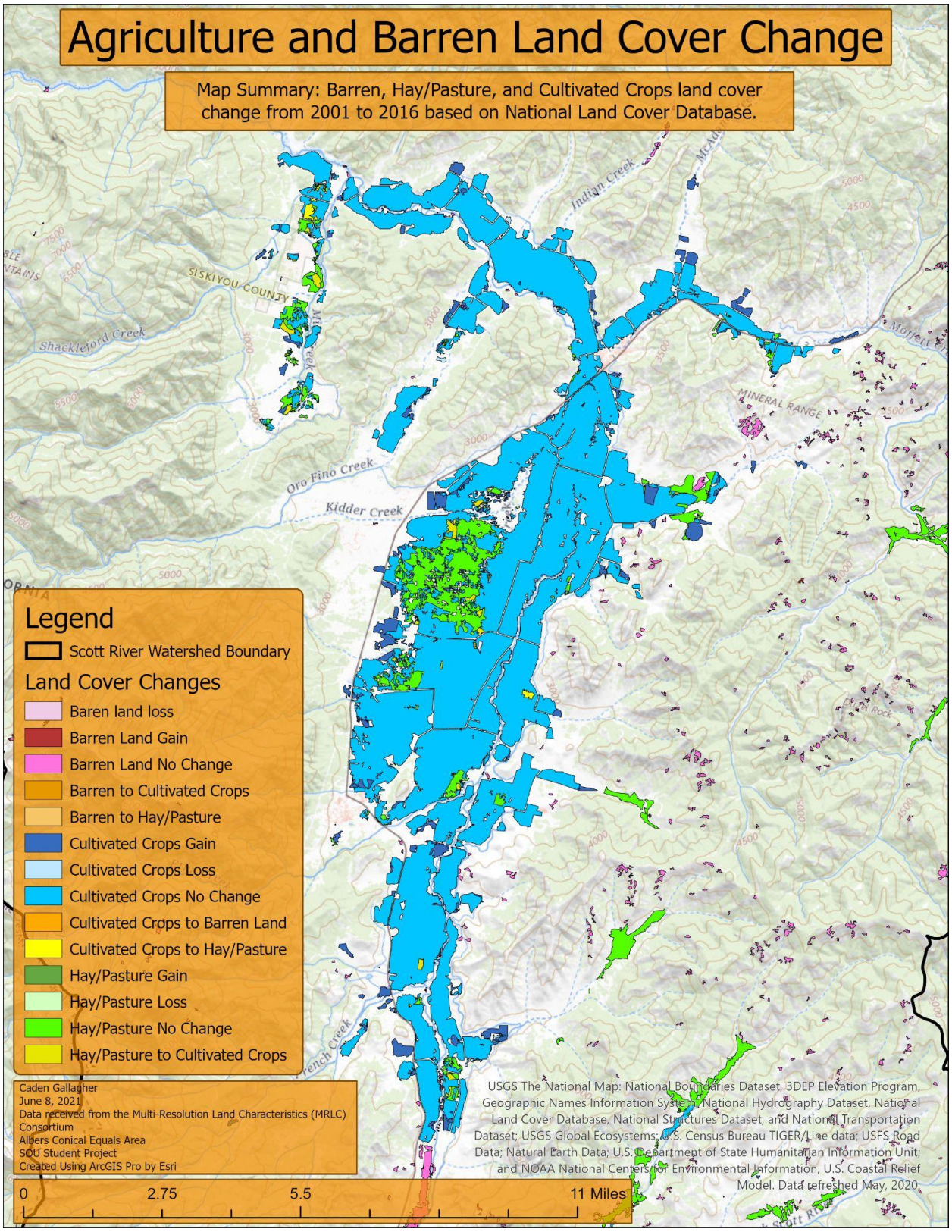
Scott River
SCOTT BAR MOUNTAINS
KLAMATH WILD AND SCENIC RIVER
Canyon Creek
Boulder Peak
MARBLE MOUNTAINS
Shackleford Creek
McAdam Creek
Humbug Creek
Kidder
Etna Creek
Willow Creek
East Fork Scott River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Scott River Watershed Boundary
Land Cover Changes
Baren land loss
Barren Land Gain
Barren Land No Change
Barren to Cultivated Crops
Barren to Hay/Pasture
Cultivated Crops Gain
Cultivated Crops Loss
Cultivated Crops No Change
Cultivated Crops to Barren Land
Cultivated Crops to Hay/Pasture
Hay/Pasture Gain
Hay/Pasture Loss
Hay/Pasture No Change
Hay/Pasture to Cultivated Crops
Caden Gallagher
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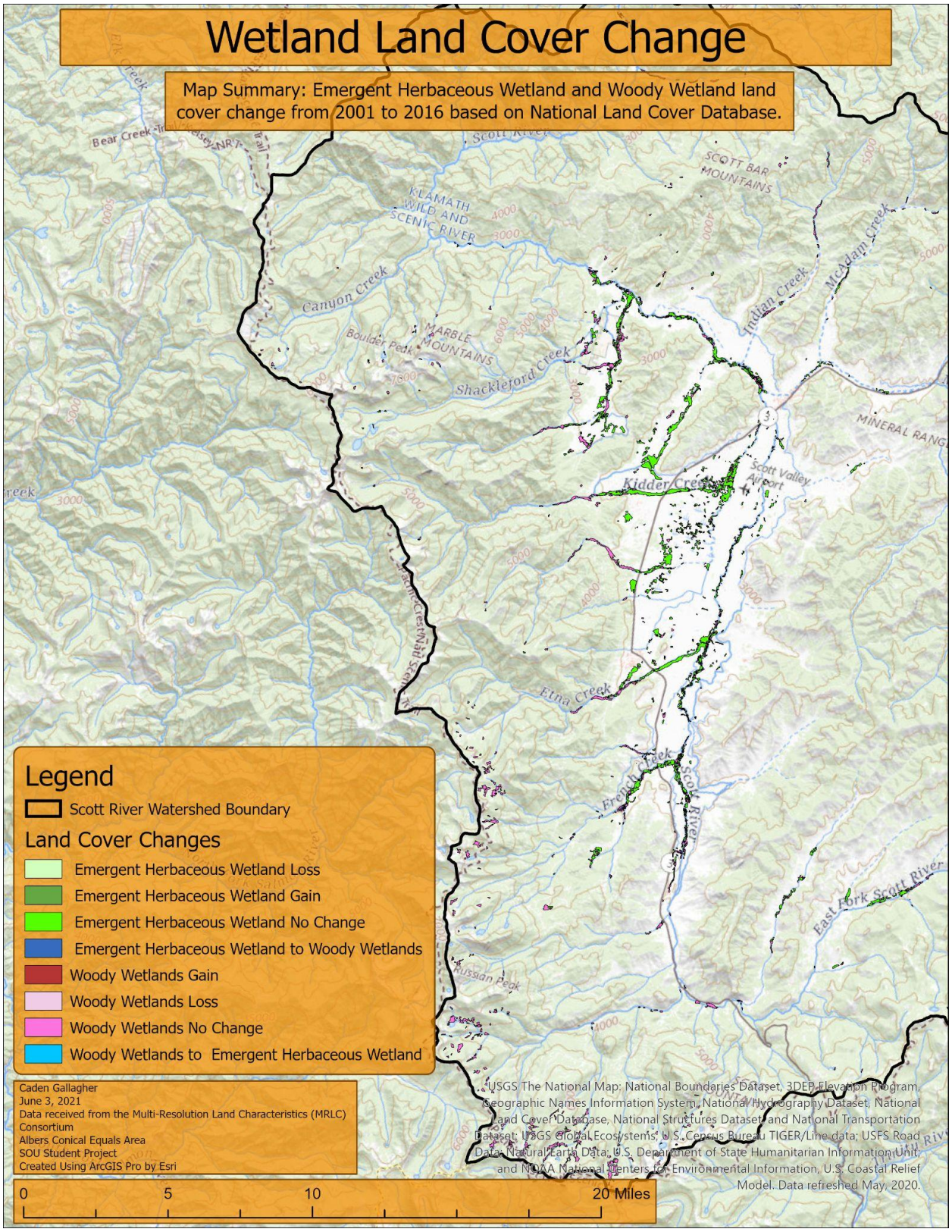
Indian Creek
Shackleford Creek
Oro Fino Creek
Kidder Creek
French Creek
SISKIYOU COUNTY
MINERAL RANGE


Wetland Land Cover Change
Map Summary: Emergent Herbaceous Wetland and Woody Wetland land cover change from 2001 to 2016 based on National Land Cover Database.
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Scott River Watershed Boundary
Land Cover Changes
Emergent Herbaceous Wetland Loss
Emergent Herbaceous Wetland Gain
Emergent Herbaceous Wetland No Change
Emergent Herbaceous Wetland to Woody Wetlands
Woody Wetlands Gain
Woody Wetlands Loss
Woody Wetlands No Change
Woody Wetlands to Emergent Herbaceous Wetland
Caden Gallagher
June 3, 2021
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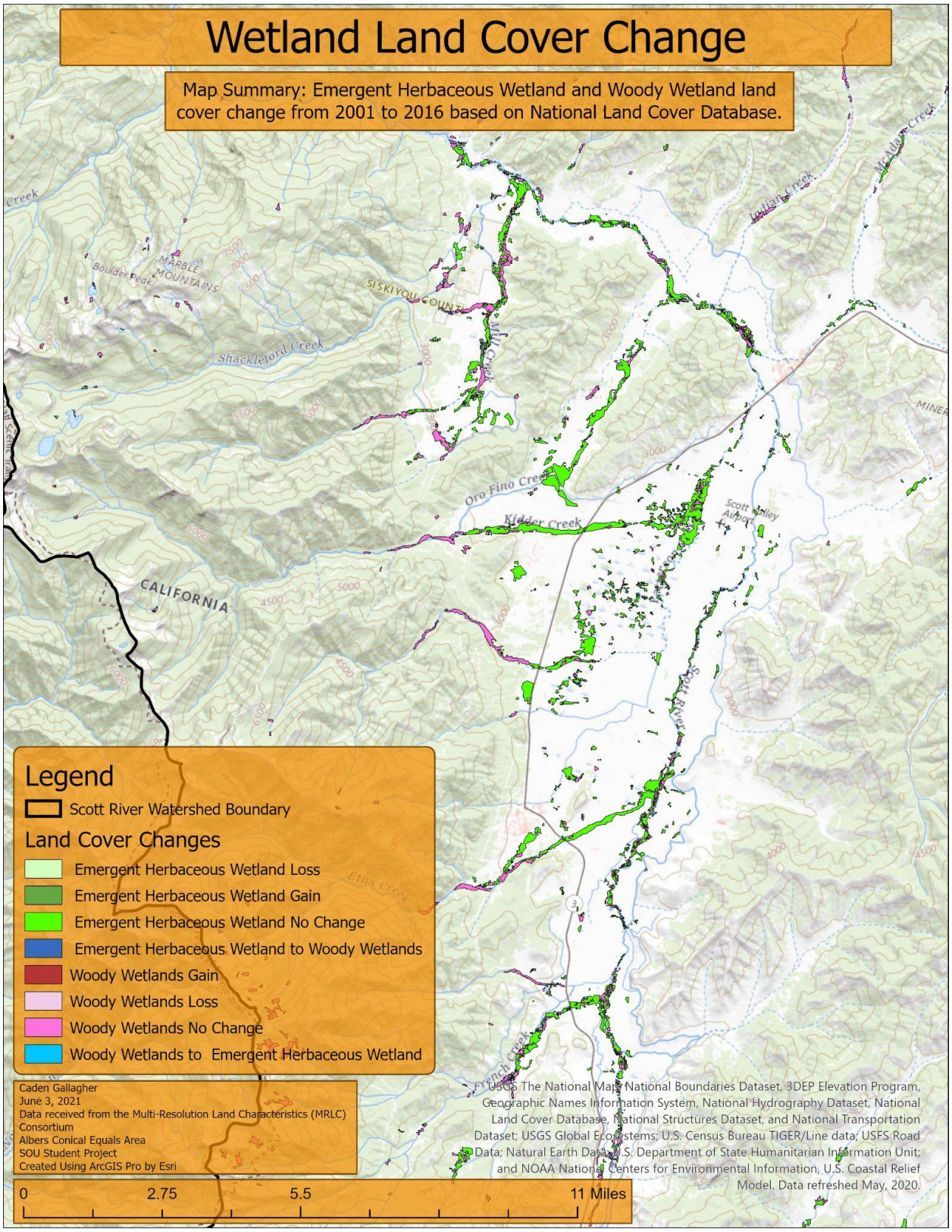
Bear Creek
Scott River
SCOTT BAR MOUNTAINS
KLAMATH WILD AND SCENIC RIVER
Canyon Creek
Boulder Peak
MARBLE MOUNTAINS
Shackleford Creek
Indian Creek
McAdam Creek
MINERAL RANGE
Kidder Creek
Scott Valley Airport
Etna Creek
French Creek
Scott River
East Fork Scott River
Russian Peak


Wetland Land Cover Change
Map Summary: Emergent Herbaceous Wetland and Woody Wetland land cover change from 2001 to 2016 based on National Land Cover Database.
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Scott River Watershed Boundary
Land Cover Changes
Emergent Herbaceous Wetland Loss
Emergent Herbaceous Wetland Gain
Emergent Herbaceous Wetland No Change
Emergent Herbaceous Wetland to Woody Wetlands
Woody Wetlands Gain
Woody Wetlands Loss
Woody Wetlands No Change
Woody Wetlands to Emergent Herbaceous Wetland
Caden Gallagher
June 3, 2021
Data received from the Multi-Resolution Land Characteristics (MRLC) Consortium
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CALIFORNIA
Shackleford Creek
Kidder Creek
Oro Fino Creek
Scott River Airport
Etna Creek
French Creek
Indian Creek
McAdam Creek
Boulder Peak
MARBLE MOUNTAINS
SISKIYOU COUNTY
Mill Creek
Scott River

Appendix E: Virtual Dashboard

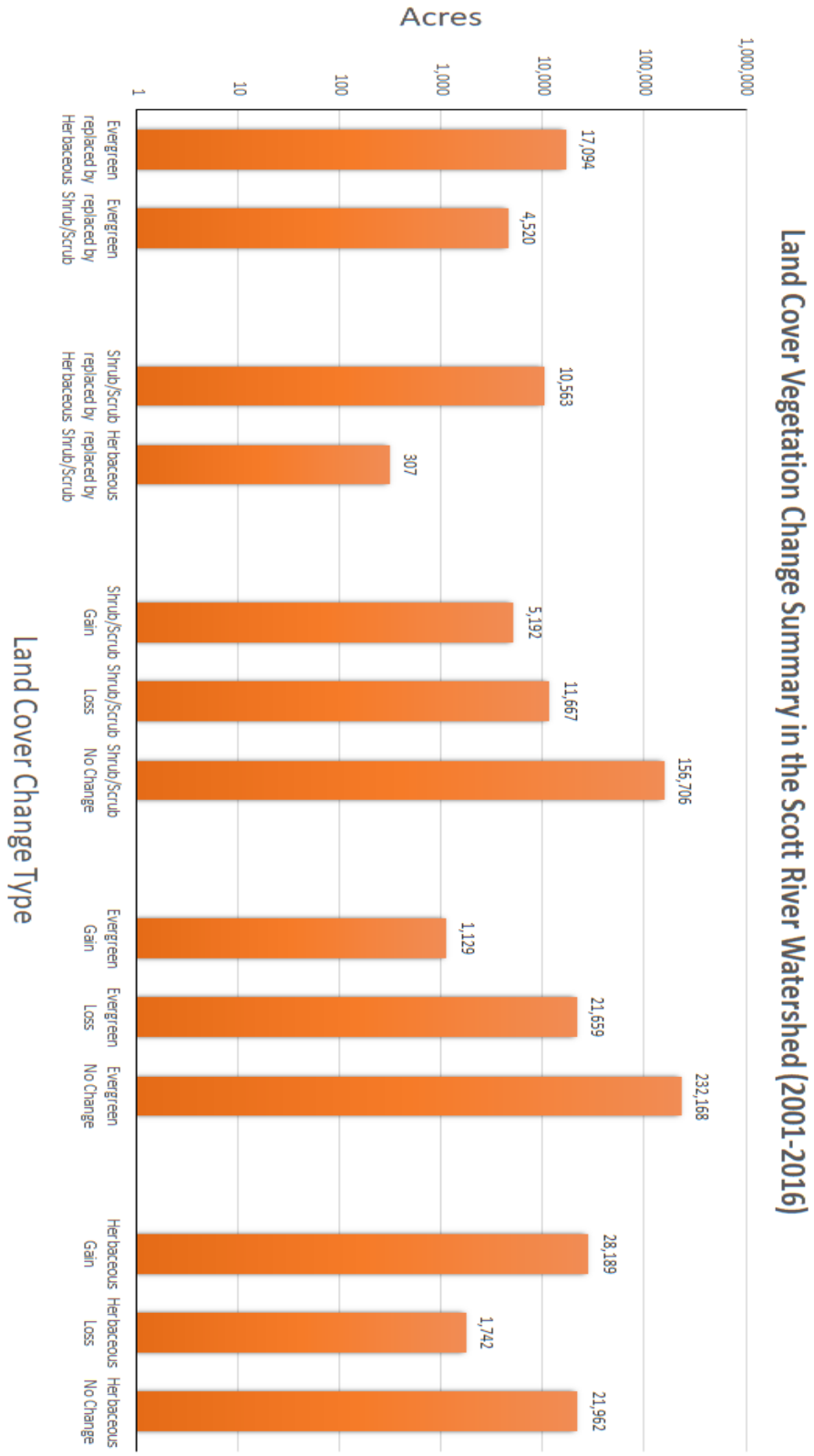
Link to new virtual dashboard here:
https://sou.maps.arcgis.com/apps/webappviewer/index.html?id=559250e00033465a899eb5a597d7311c

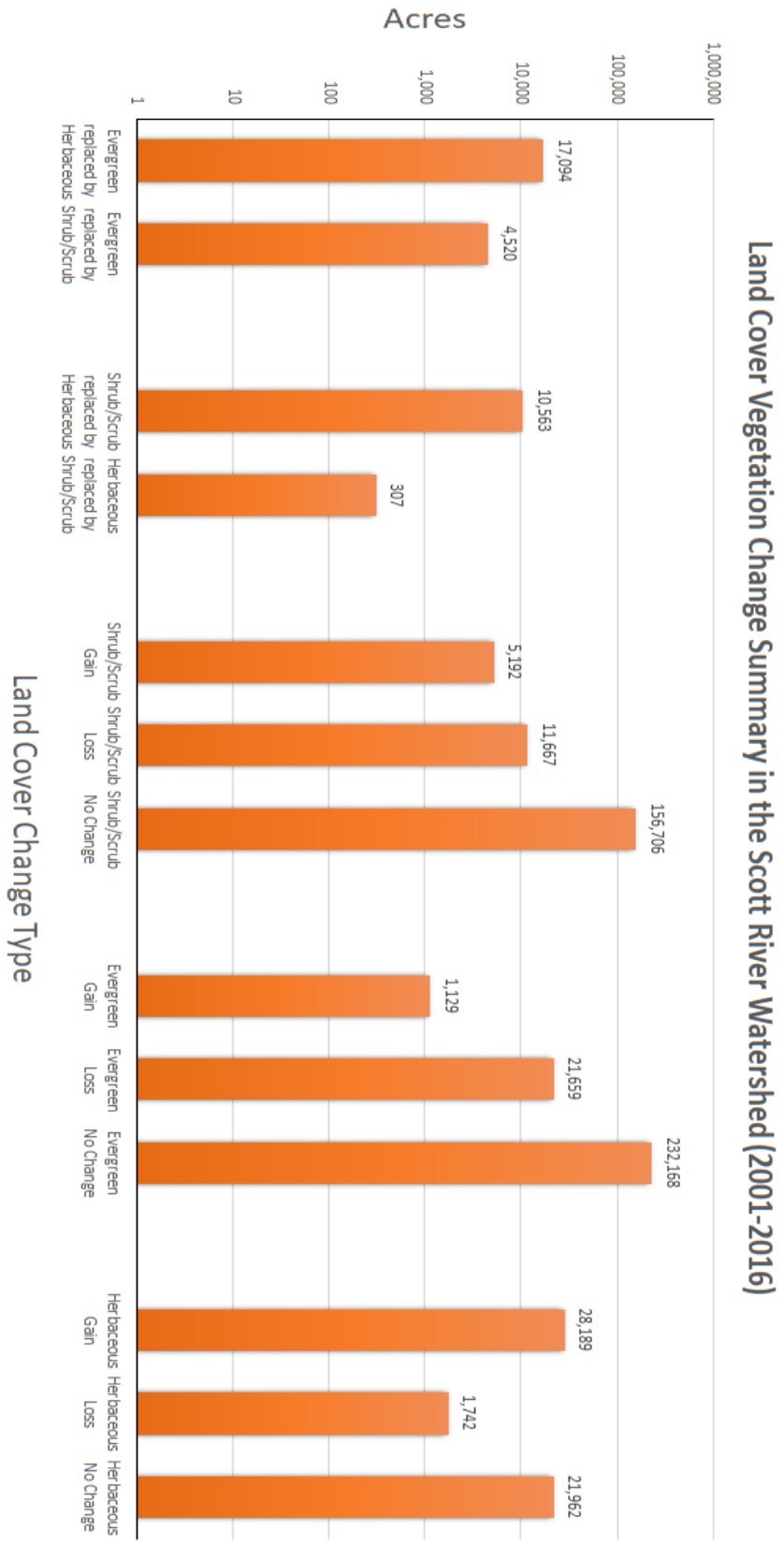
Link to original climate visualizer here:
https://storymaps.arcgis.com/stories/cd28988790394ff7bc6669c059103803/edit

Appendix F: Survey Response Summary Data

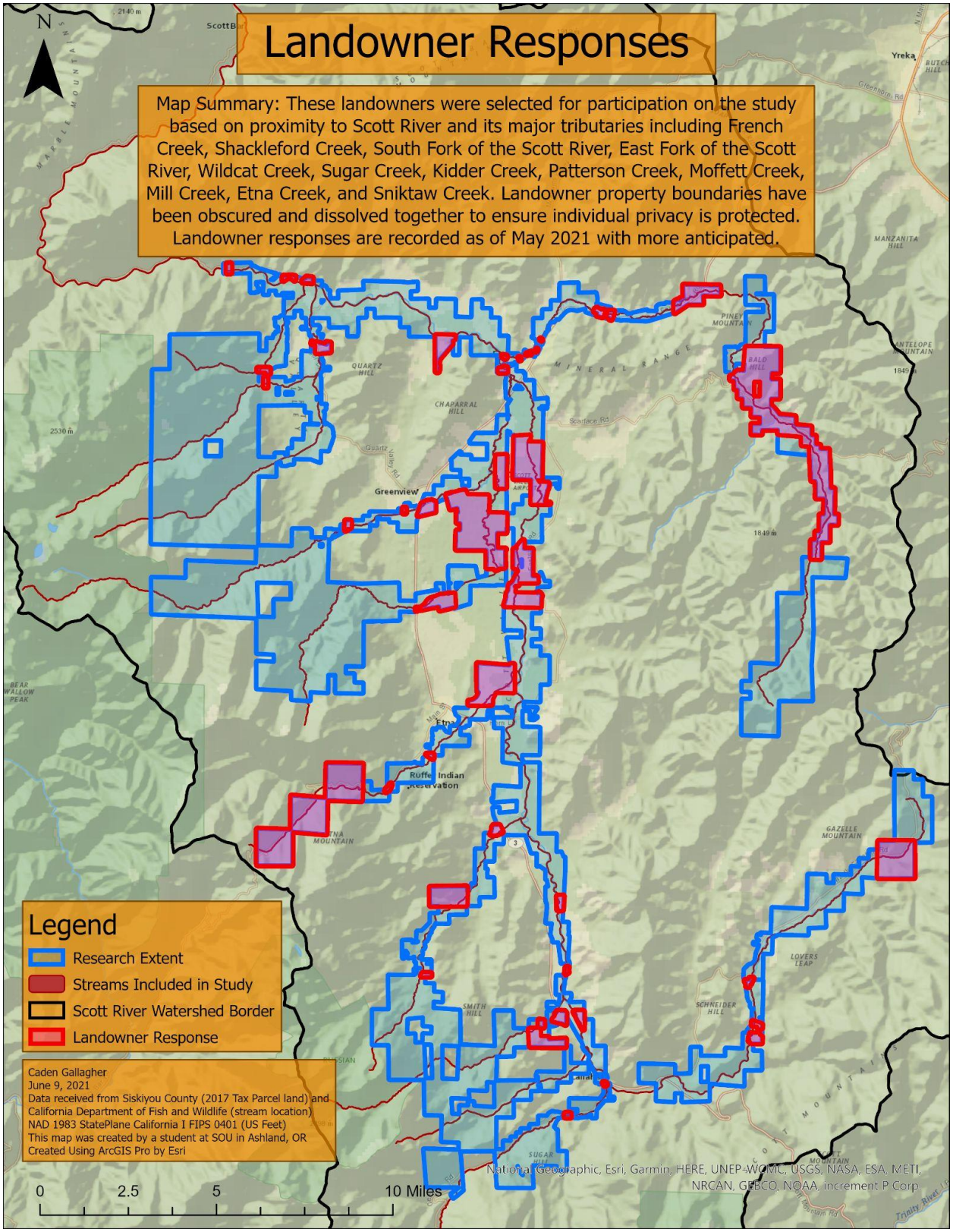
See attached Excel file

Appendix G: Land Change Summary (with acreage data)

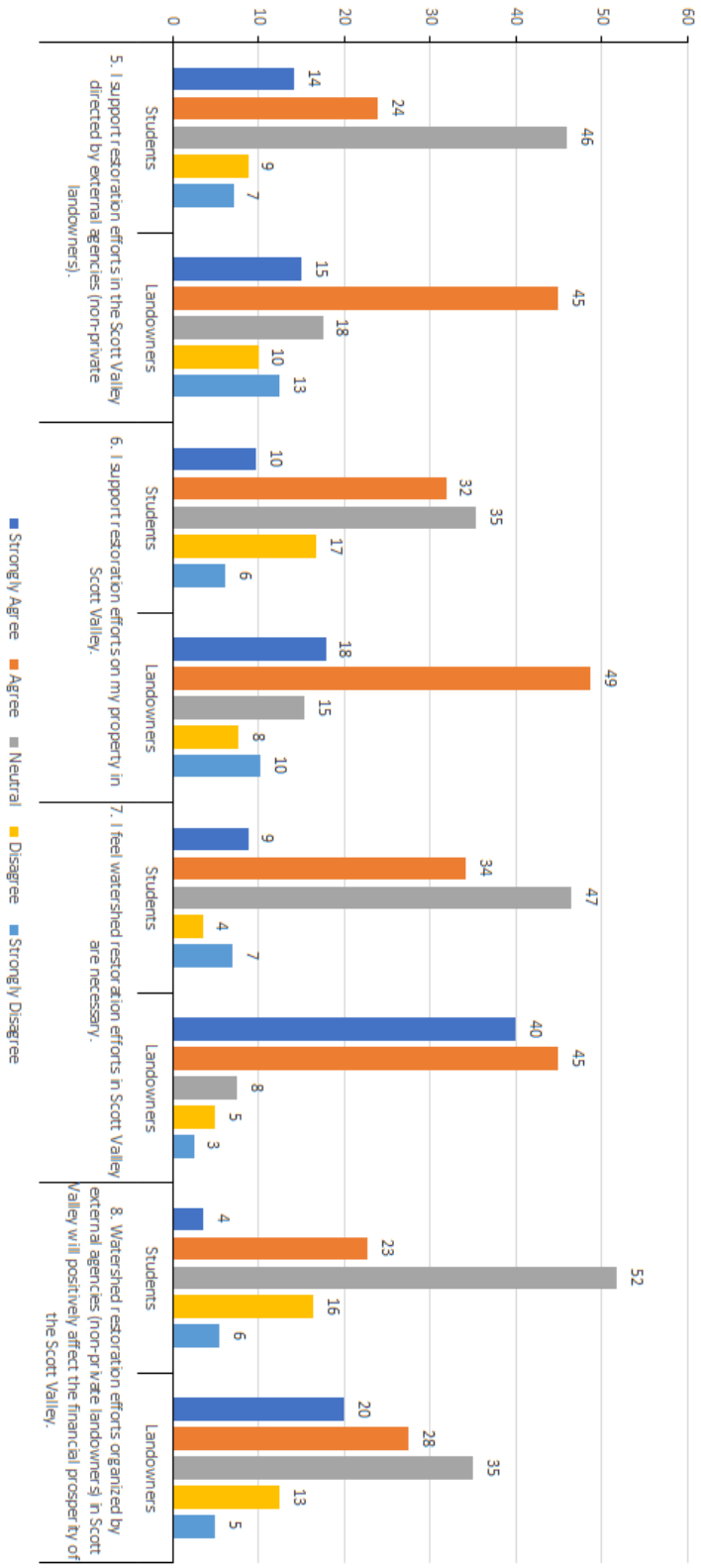



Land Cover Vegetation Change Summary in the Scott River Watershed (2001-2016)
Acres
1,000,000
100,000
10,000
1,000
100
10
1
17,094
4,520
10,563
307
5,192
11,667
156,706
1,129
21,659
232,168
28,189
1,742
21,962
Evergreen replaced by Herbaceous
Evergreen replaced by Shrub/Scrub
Shrub/Scrub replaced by Herbaceous
Herbaceous replaced by Shrub/Scrub
Shrub/Scrub Gain
Shrub/Scrub Loss
Shrub/Scrub No Change
Evergreen Gain
Evergreen Loss
Evergreen No Change
Herbaceous Gain
Herbaceous Loss
Herbaceous No Change
Land Cover Change Type

Appendix H: Landowner Survey Response Visualization



Appendix I: Restoration Questions



Appendix J: Natural Resource Management Questions