FINAL PROJECT EXECUTIVE SUMMARY

Title:

Bend, Boise, and Bozeman: Better Understanding Environmental Impacts in Three 21st Century Boomtowns

Authored by **Matthew T. Bowling** for the degree of Master of Sciences (M.S.) in Environmental Sciences, Oregon State University

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Bend, Boise, and Bozeman are three of the fastest growing communities in the western United States. According to the U.S. Census Bureau, between 2010 and 2020, Bend, Boise, and Bozeman grew by 29.4 percent, 14.6 percent, and 42.9 percent, respectively. This compares to a growth rate of 7.4 percent nationally during the same period. This final project analyzed whether suburban and exurban sprawl was occurring in these communities and then investigated what adverse environmental impacts, if any, were occurring because of their growth patterns. Fundamental questions about Bend, Boise, and Bozeman were explored. First, what do these three communities, in three separate states, with three unique cultural identities, hold in common that keeps attracting new residents? Second, can these communities keep growing, at their current rates (high above the national average), and remain resilient and sustainable in the Era of Climate Change?

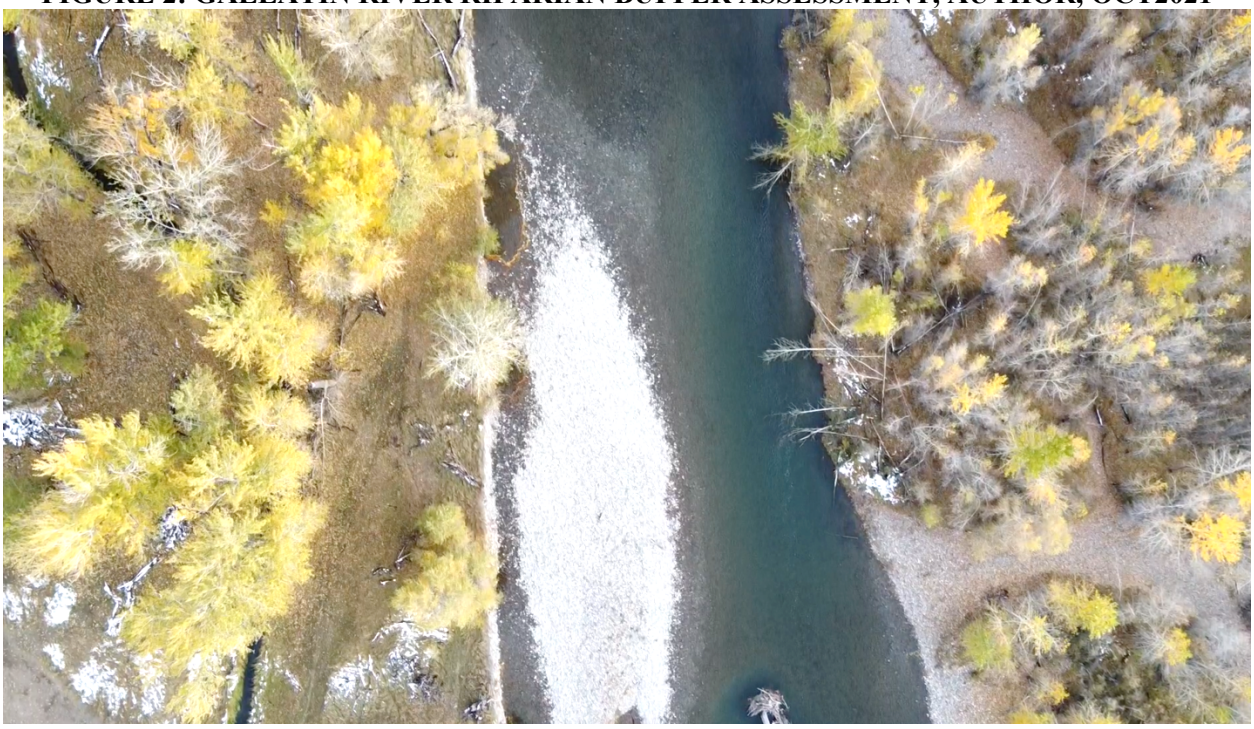
FIGURE 1: DEVELOPMENT IN THE BOISE HILLS, AUTHOR, OCT2021

A toolbox approach was used to answer these questions, with both quantitative and qualitative measures being employed. Datasets from the U.S. Census Bureau's 2020 Decennial Census were used to confirm population counts and calculate estimates for population per square. Multiple urban to rural interface analyses were conducted using an uncrewed aerial vehicle (UAV) and windshield/walking surveys. The UAV was used to assess riparian buffer widths, vegetative

robustness, and surrounding land uses on 800 to 1000 meter reaches on major rivers in each respective metropolitan area. On these same waterways, the Deschutes River (Bend, Oregon), the Boise River (Garden City, Idaho), and the Gallatin River (Gallatin County, Montana), water samples were taken, and water quality tests were conducted.

Bend, Boise, and Bozeman were particularly intriguing case studies, as they are each set is spectacular natural settings. Their proximity to outdoor recreational opportunities is one of the key factors that draws migrants to them and is directly correlated to their natural settings. Any adverse impacts to their respective natural environments would directly take away from what makes them exceptional, from the perspective of the people who already live in these communities and for those who are choosing to move them. They each have historic building stock located within walkable and bikeable downtown cores, set within classic street grids and pedestrian scaled buildings filled with shops and restaurants. All three cities are growing rapidly, but much of the residential and commercial construction (mostly residential) is occurring on their outer fringes, where land is cheaper than within the downtown core. These lands were previously vacant, shrublands, woodlands, or used for agricultural purposes.

FIGURE 2: GALLATIN RIVER RIPARIAN BUFFER ASSESSMENT, AUTHOR, OCT2021

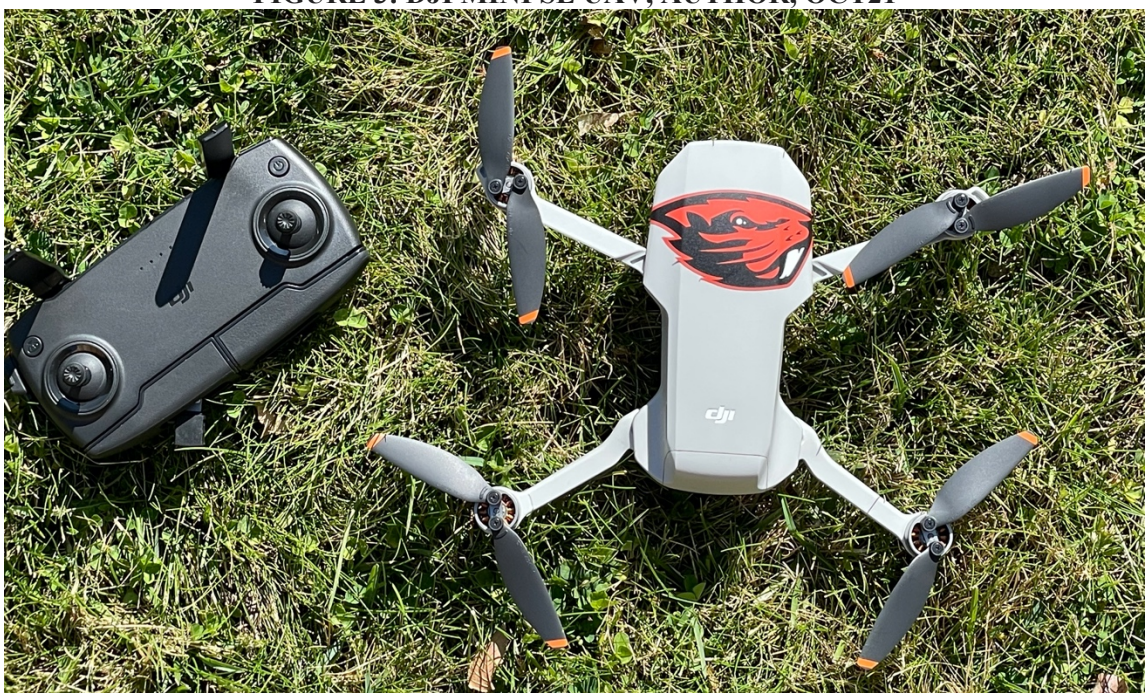


The methodology employed to measure riparian buffer widths, assess riparian vegetation health, and examine surrounding land uses was a success. The granular level detail provided by low altitude (110 to 120 meter) UAV flights would have been difficult, expensive, and dangerous to obtain through other methods. The data delivered in post-production was essentially real-time. The amount of distance that was covered, in a relatively short amount of time (one to two days for each 800 to 1000 meter reach) would make scaling a similar operation possible. Riparian areas involving entire streams, rivers, and waterbodies could be analyzed over a series of days/weeks

depending on their size. The information garnered through a large-scale assessment, as described, would be essentially real-time.

If specific species identification was required, the use of a UAV might not prove as practical on a reach the same scale as the ones analyzed here, which ranged from 800 to 1000 meters. However, the use of a UAV could prove invaluable for streambank riparian vegetation identification (specific species) in hard-to-reach areas, steep slopes, or fast-moving water. In such a circumstance, the UAV would need to be flown at a lower altitude, potentially closer to hazards (i.e. trees). Handled in small segments, such a technique could prove quite useful for specific species identification in riparian buffer zones.

FIGURE 3: DJI MINI SE UAV, AUTHOR, OCT21

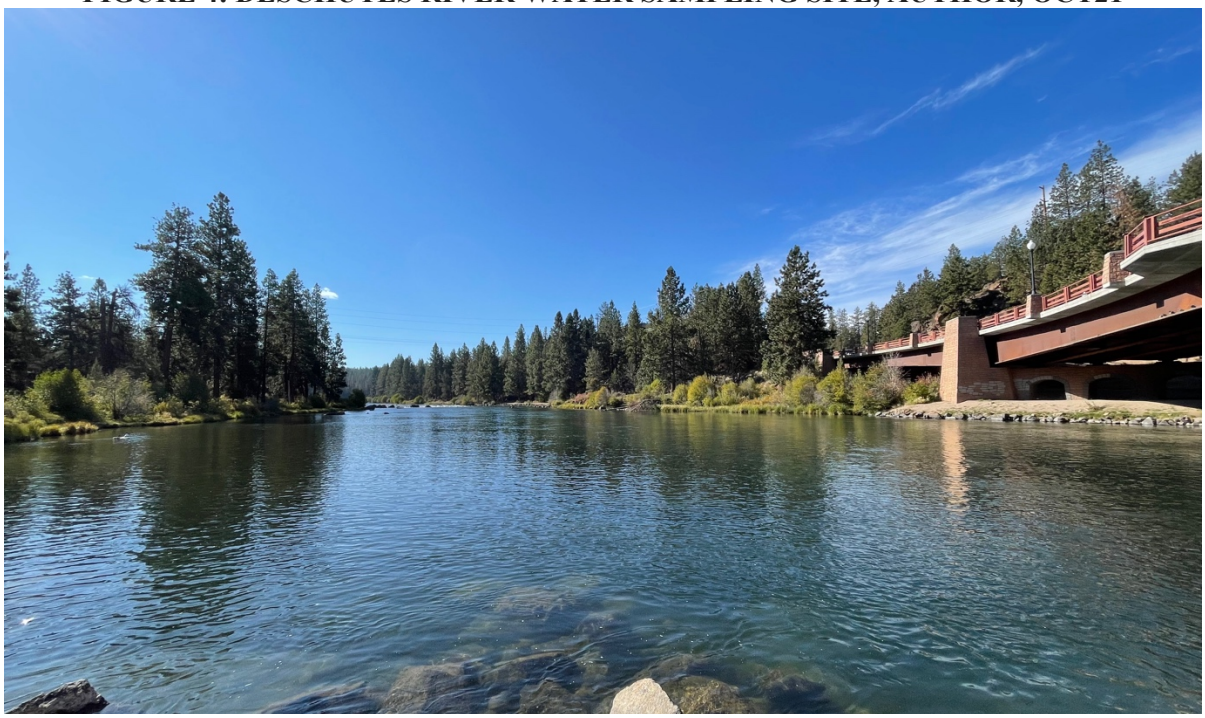


Riparian buffers are critical, especially in urbanized areas, for modulating water temperature, absorbing excessive nutrients and pollution, and providing habitat to a variety of terrestrial, amphibian, and aquatic species. The species that are incubated in riparian areas are often sources of food for trout species. All three of the rivers examined in this report are world-renown trout fisheries. A degradation in the robustness of the riparian buffers could have serious consequences for the trout species that inhabit them, which are dependent on cold, clean water to survive. In all three instances, the Deschutes River, the Boise River, and the Gallatin River, the riparian areas examined were intact, with ample vegetation (trees, woody shrubs, herbaceous plants) within 30.4 meters of each riverbank.

The results from the water quality tests that were conducted on the Deschutes River, the Boise River, and the Gallatin River corresponded to high water quality. Water samples were taken using a LaMotte Earth Force Low Cost Water Quality Monitoring Kit. One sample point was selected on each of the respective rivers. In all three instances, the water temperature was cold, the turbidity was low, the pH was excellent, and the percent saturation was within the threshold of what was to

be expected for these respective river sections, given the high flow rates and time of year (colder water holds more dissolved oxygen). These results should not serve as the foundation for definitive conclusions to be made about the overall water quality of the Deschutes River, the Boise River, or the Gallatin River. A regular sampling schedule, with dozens of tests completed over a defined period would provide the basis more scientifically sound conclusions. Recreational-based tourism brings visitors to these waterways for fishing, rafting, hiking, wildlife viewing, and other outdoor activities. The Deschutes River, the Boise River, and the Gallatin River also serve as important sources of water to farmers and ranchers in Bend, Boise, and Bozeman. Farming and ranching are at the foundation of these localized economies, they have been integral economic fixtures within these communities since they were founded. Any reduction in water quality could have significant financial repercussions, jeopardize biodiversity, and endanger human health.

FIGURE 4: DESCHUTES RIVER WATER SAMPLING SITE, AUTHOR, OCT21

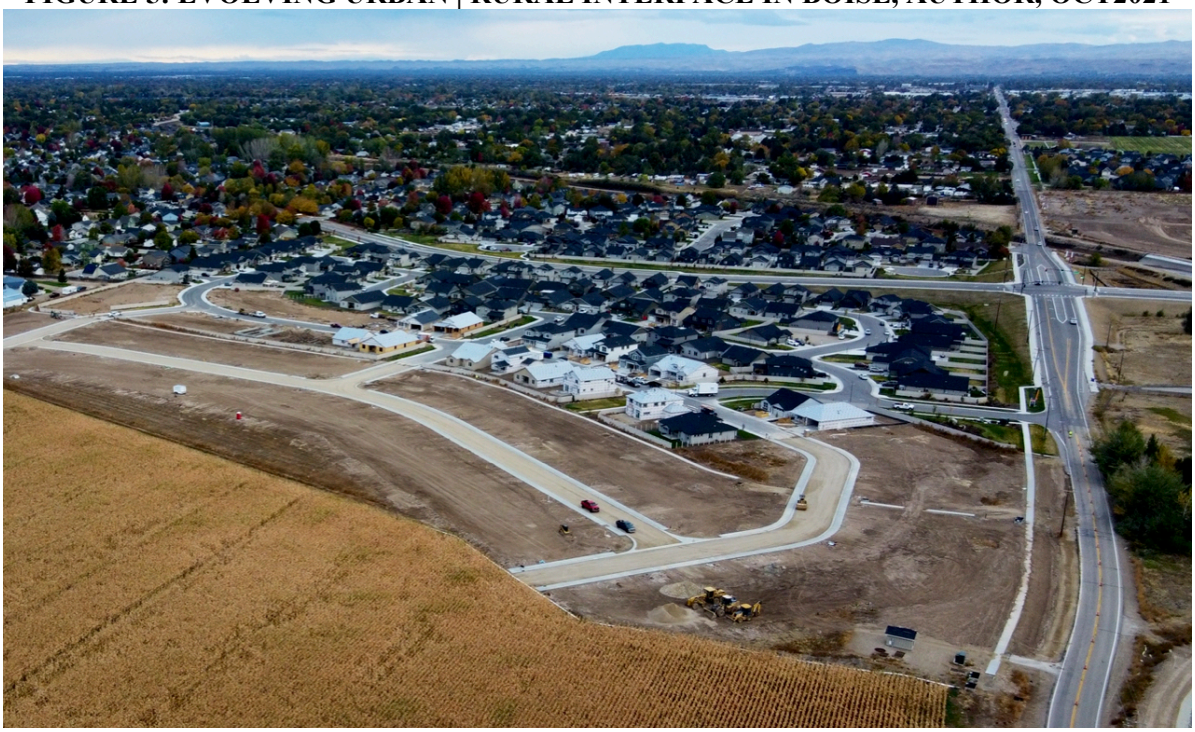


The urban to rural interface analyses that were completed for Bend, Boise, and Bozeman yield results that were unique to each community. Comparatively, urban to rural interfaces varied in each metropolitan area based on the number of jurisdictions exerting land use and zoning control. In Bend, there was one jurisdiction, working in conjunction with the Deschutes County and the State of Oregon. In Boise, there were no less than 15 jurisdictions, spread across multiple counties. In Bozeman, there were two jurisdictions and several unincorporated areas under Gallatin County's jurisdictional authority. Urban to rural interfaces were readily visible in Bend, corresponding to the City's urban growth boundary (UGB). In Bozeman, they were identifiable and generally concentrated in specific areas near the City of Bozeman and the City of Belgrade. In Boise, urban to rural interfaces were erratic, scattered amongst a hodgepodge of suburban and exurban sprawl. The conversion of lands that were previously vacant, shrubland, woodland, or agricultural in use to residential uses can equate to adverse impacts to biodiversity, although some generalist species have shown a remarkable ability to adapt to urbanization. For instance, some

mammals in urban environments have grown larger in size due to the abundance of readily available food sources (Hantak et al. 2021).

When lands are converted from shrublands, desert, woodlands, or agricultural fields to a residential use (a pattern of use conversion seen repeatedly in all three communities examined), species can be displaced, but different species, species that are able to adapt to the type of habitat afforded in a homeowner's garden, trees, or shrubs could take their place. Urbanization changes where and how species are grouped. Specialist species, typically dependent on the original localized conditions, are replaced generalist species that can adapt to the new conditions that emerge and are better equipped to survive in an evolving landscape. This process, of specialists being replaced by generalist, is called "biotic homogenization" (Concepción et al. 2015). Overall, biotic homogenization is damaging to biological diversity.

FIGURE 5: EVOLVING URBAN | RURAL INTERFACE IN BOISE, AUTHOR, OCT2021



While their respective population densities are increasing, single-family detached homes are being constructed at high rates. Single-family detached homes typically use more land than multifamily buildings, semi-detached homes, and townhouses in that it takes more land to house a fewer number of people. In terms of building form, they among the least efficient in terms of mitigating adverse environmental impacts. The subdivisions that many of these homes are in are over four miles (one-way) from the respective downtown cores, which potentially leads to increased vehicle miles traveled for work and entertainment, and potentially higher carbon dioxide emissions and lower air quality. This presents a challenge for land use planners working to mitigate adverse environmental impacts. In terms of building form, most Americans live in single-family detached homes and prefer doing so. Amongst all homebuyers and sellers, 85 percent noted a preference for single-family detached homes over multifamily options (Falcon 2019). This preference is seen in the types of homes being constructed in Bend, Boise, and Bozeman.

This research revealed that increased population density and sprawl are not mutually exclusive. Siloed, specialist-based, land management mechanisms will not work to adequately mitigate adverse effects to the natural environment. The issues are too inter-related, with nexuses to a range of environmental and socioeconomic issues that stretch across disciplines and fields of study. The challenges associated with rapid population growth, migratory patterns, and the development that is occurring in Bend, Boise, and Bozeman are regional in scale, and they are increasingly cross-state issues. The fiscalization of land use, i.e. municipal dependence on the tax revenue generated by development and the local economy's dependence on the expectation that construction will not stop, has created a competitive environment where cities, regions, and states are competing for residents. As the country, overall, continues to level in population in the 21st century, the competition for shrinking pool of potential residents will likely become more intense, which could lead to a situation where regional and cross-state cooperation is unlikely to occur.

The hope for a better environmental outcome lies in the fact that Bend, Boise, and Bozeman, and others, have no choice but to cooperate. The challenges presented by the Era of Climate Change are too great for a municipal government to overcome, absent regional and cross-state mutual trust and cooperation. To achieve the goals of sustainability, resiliency, equity, and environmental protection needed by Bend, Boise, and Bozeman to ensure continued vitality and growth, fully integrated environmental impact assessment mechanisms, employed at a regional scale are required to sufficiently handle these complex, inter-related issues. All three of the metropolitan areas examined for this report are employing environmental growth management techniques that could be applied cross-jurisdictionally to cities across the United States, even cities that are not growing population or geographic footprint. The methodology used during this research, the extensive use of a UAV and field level observation, was of high value and could be replicated in a variety of contexts, and at multiple scales

References:

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