UCSU20/18.2/P81/1998
c.2

Effects of Population Growth on Wildlife Habitat in Colorado

A Briefing Paper for the Colorado Division of Wildlife Commissioners -- June 1998

N. Thompson Hobbs and David M.Theobald

Wildlife and people need habitat in Colorado. Wildlife need forest and range and wetlands. People need places to live, places to work, roads to travel on, and schools to educate their children. Meeting the "habitat" needs of an expanding human population causes fundamental changes in the way land is used in Colorado. Changes in land-use, in turn, can cause marked shifts in habitat available for Colorado's wildlife. There is widespread consensus among professional biologists and wildlife managers that habitat loss to development is the foremost threat to the diversity, abundance, and distribution of Colorado's wildlife. However, this broad agreement is based largely on local experience and is not founded on a comprehensive, statewide analysis of habitat loss in the state. Here, we offer data on the history of habitat loss to development in Colorado and provide projections of the kinds of losses that can be reasonably expected in the future.

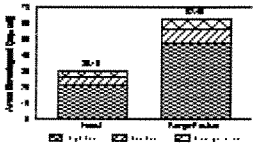
The rapid expansion of the human population in Colorado is causing fundamental changes in our environment. During 1990 to 1995, Colorado's population grew by 452,112 people, a growth rate exceeding 2.5% annually. During that period, more people were added to Colorado's population than any other state in the nation except Arizona. About 60% of the net increase in population resulted from immigration into the state. Nine counties in Colorado experienced growth rates exceeding 8%--if such rates of growth continue, we can reasonably expect the population in these counties will double every nine years. It is not likely that these patterns of growth will reverse anytime soon---by the 2020the state will likely be home for 5.2 million people, an increase of almost 1.25 million in 25 years.

The rise in Colorado's population has caused dramatic increases in housing densities throughout the state. During 1960-1990 large areas of the state changed from rural densities (1 house per 40-80 acres) to exurban densities (1 house per 2-10 acres) (Figure 1 and 2, Table 1). In some counties, large portions of the rural landscape developed at exurban or greater densities during this 30 year period (see Figure 2, insert on the Roaring Fork Valley). Models based on census data and demographic projections predict continued expansion of developed areas in the state (i.e., through the year 2020, Figure 3, Table 1).

Table 1. Total acreage and trends of development by category in Colorado during 1960-2020. Data source is U.S. Bureau of Census Block-group statistics.

Development Category	Housing Density (acres/unit)	Area (sq. mi.)			Annual Growth
		1960	1990	2020	1960
Urban	<2	166	519	681	
Suburban	2 - 10	164	483	702	
Exurban	10-40	1080	3935	6491	
Ranch	40-80	1084	2903	3869	
Rural	>80	53730	49549	46034	

We analyzed several data sets to quantify effects of housing development on wildlife habitat in Colorado. We define wildlife habitat in a general way to include all areas of the state with natural vegetation as the predominant land cover, including rangeland and pasture, forest, and wetlands. We used the National Resource Inventory collected by the U. S. Natural Resource Conservation Service (formerly the Soil Conservation Service) to estimate the area of forest, rangeland, and pasture that were converted to urban use during 1982-1992. We also used data from the US Census Bureau, the U.S. Geological Survey and the Colorado Gap Analysis Project to estimate historical rates of habitat loss (1960-1990) from major land cover types and to project rates of loss into the future (1990-2020).



COLORADO STATE PUBLICATIONS LIBRARY
UCSU20/18.2/P81/1998 c.2 local
Hobbs, N. Tompson/Effects of population
3 1799 00034 9688

Figure 4. Areas of forest, range, and cropland developed at urban and suburban densities in Colorado during 1982-1992. Data source is the National Resource Inventory.

National Resource Inventory (NRI) data reveal that 30 square miles of forest and 62 square miles of rangeland and pasture were urbanized in Colorado during 1982 to 1992 (Figure 4). Although these statistics reveal a substantial conversion of habitat, the NRI data do not account for diffuse development that cannot be characterized as "urban" (35 acre tracts, for example). To account for effects of such development, we overlaid U.S. Bureau of Census maps of housing density on U.S. Geological Survey maps of land cover. This provided an estimate of the area of broad habitat types that were developed across a range of housing densities. Nineteen hundred square miles of forest, range, and wetland habitat were developed at exurban or higher densities during 1960-1990 (Table 2). We predict that rapid development of forest, range, and wetlands observed during 1960-1990 will continue. The area developed in these habitat types will almost double during 1990 to 2020 (Table 2).

Table 2. Data and projections of area (sq. mi.) of habitat types in Colorado developed at densities ranging from rural to urban during 1960 to 1990. Each cell in the table gives the area in each habitat and density class during a given year. See Table 1 for definitions of development densities. Data sources are U.S. Bureau of Census Block Group Statistics and U.S. Geological Survey Land-Use Land Cover data.

Development	Forest			Range			Wetlands		
Category	1960	1990	2020	1960	1990	2020	1960	1990	2020
Urban	0	5	17	2	41	73	0	1	2
Suburban	6	34	77	11	107	182	1	3	7
Exurban	138	931	1638	191	1112	2242	17	36	44
Ranch	269	728	925	198	1053	1556	15	19	27
Rural	6577	5372	4450	26397	25291	23894	188	165	146

Similar trends in habitat conversion were obtained by overlaying Bureau of Census maps on maps of vegetation types produced by the Colorado GAP Analysis Project (Table 3). Based on these data, we estimate that 1,968 square miles of habitat were developed at exurban or greater densities during 1960-1990. We project that an additional 2,042 square miles will develop during 1990-2020. Using these data and projections, we mapped the native habitats in the state that are likely to experience the greatest development during 1960-2020 (Figure 5).

Table 3. Habitat area (sq. mi.) developed at exurban or greater densities during 1960-1990 and projections of developed area in 2020. Data sources are U.S. Bureau of Census Block Group Statistics and Colorado Gap Analysis Project Vegetation Classification.

Land Cover Type	Developed Area 1960	1990	2020	Total Land Area 1990	% of Total Land Area Developed 1960	1990	2020
Rangeland - Grasses	107	649	1201	21047	0.51%	3.09%	5.71%
Rangeland - Shrub	70	439	947	19824	0.35%	2.21%	4.78%
Forest - Deciduous	9	77	188	4888	0.19%	1.58%	3.84%
Forest - Evergreen	187	1126	1948	30019	0.62%	3.75%	6.49%
Shoreline	3	12	16	351	0.78%	3.44%	4.46%
Wetland (non-forested)	33	74	119	819	3.98%	9.03%	14.52%

These shifts in land use represent large impacts on habitat in terms of area, but nonetheless, they represent a relatively small fraction of the total habitat available in the state. In most cases the percentage of the total area of major habitat types that will be developed at exurban or greater density in 2020 is less than 7% of the total area of those types within the state. The single exception to that finding is non-forested wetlands, where we anticipate that 14.5% of the total habitat available will be developed by 2020. However, this analysis is extremely conservative---it simply estimates the "footprint" of development and not the effects that emanate from developed areas. Our analysis fragmenting effects of developed areas, but it is clear that the potential for these effects is enormous. For example, 80% of forested land in Colorado is within 2 miles of private land, land that could be developed. We do not account for effects of altered natural processes resulting from human intervention (fire suppression on the forest fringe, for example). Moreover, the observation that a relatively small portion of the Colorado landscape has been developed should not be taken to mean that the impacts of development on habitat are not significant. It simply means that there is time to do something about these impacts while significant habitat remains undisturbed.

Conclusions

Rapid increases in the human population are causing substantial change in the landscapes of Colorado. Two separate analyses revealed that about 4000 square miles of habitat will be developed during 1960-2020, roughly 60-70 square miles per year. By far the greatest share of this development will be in low-density (10-40 acres per house) categories. This implies that developing strategies to make such development "friendly" to wildlife will pay large dividends in meeting the habitat needs for Colorado's people and Colorado's wildlife.

Figure 1. Development density in Colorado during 1960. Data from U.S. Bureau of Census.

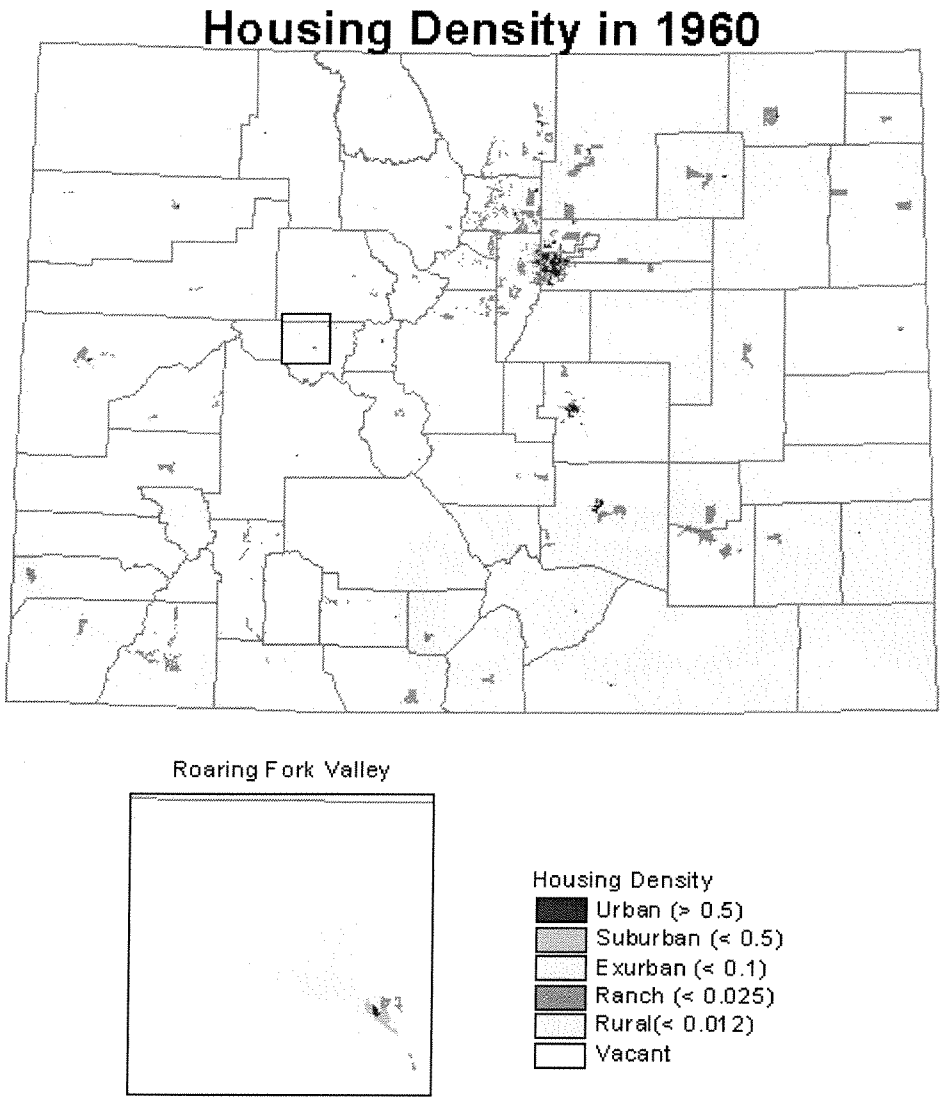
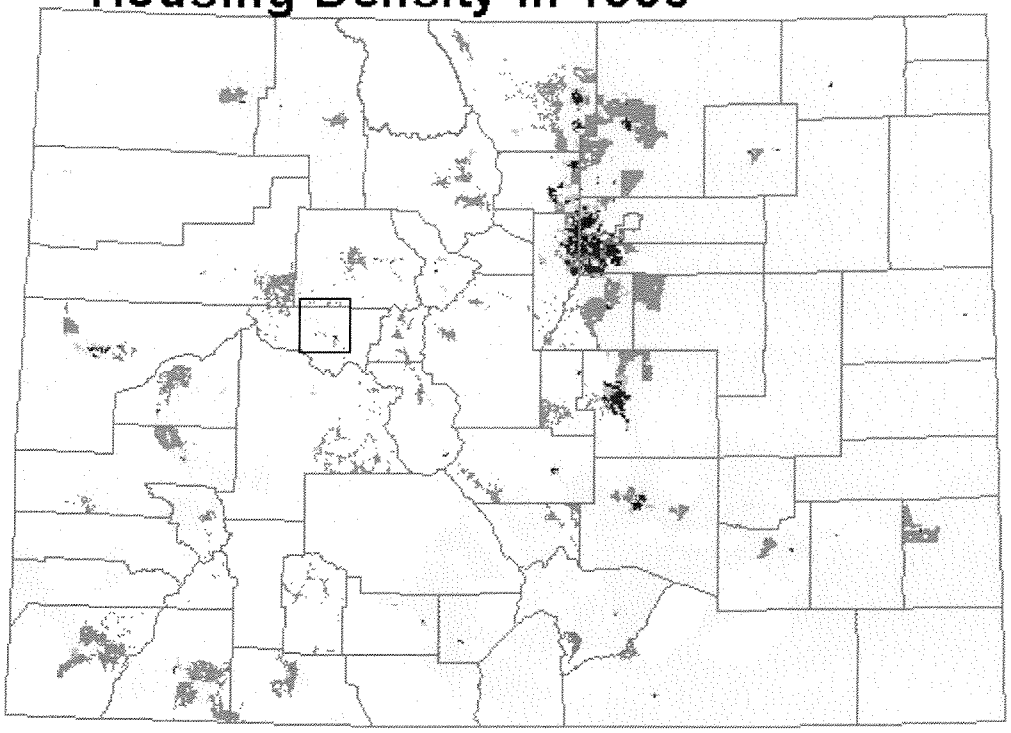
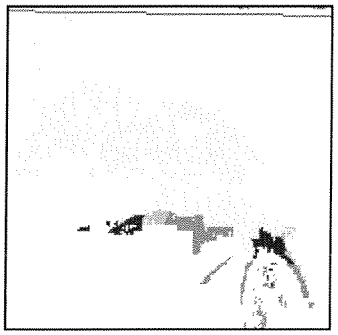


Figure 2. Development density in Colorado during 1990. Data from U.S. Bureau of Census.

Housing Density in 1990



Roaring Fork Valley



Housing Density
- Urban (> 0.5)
- Suburban (< 0.5)
- Exurban (< 0.1)
- Ranch (< 0.025)
- Rural(< 0.012)
- Vacant

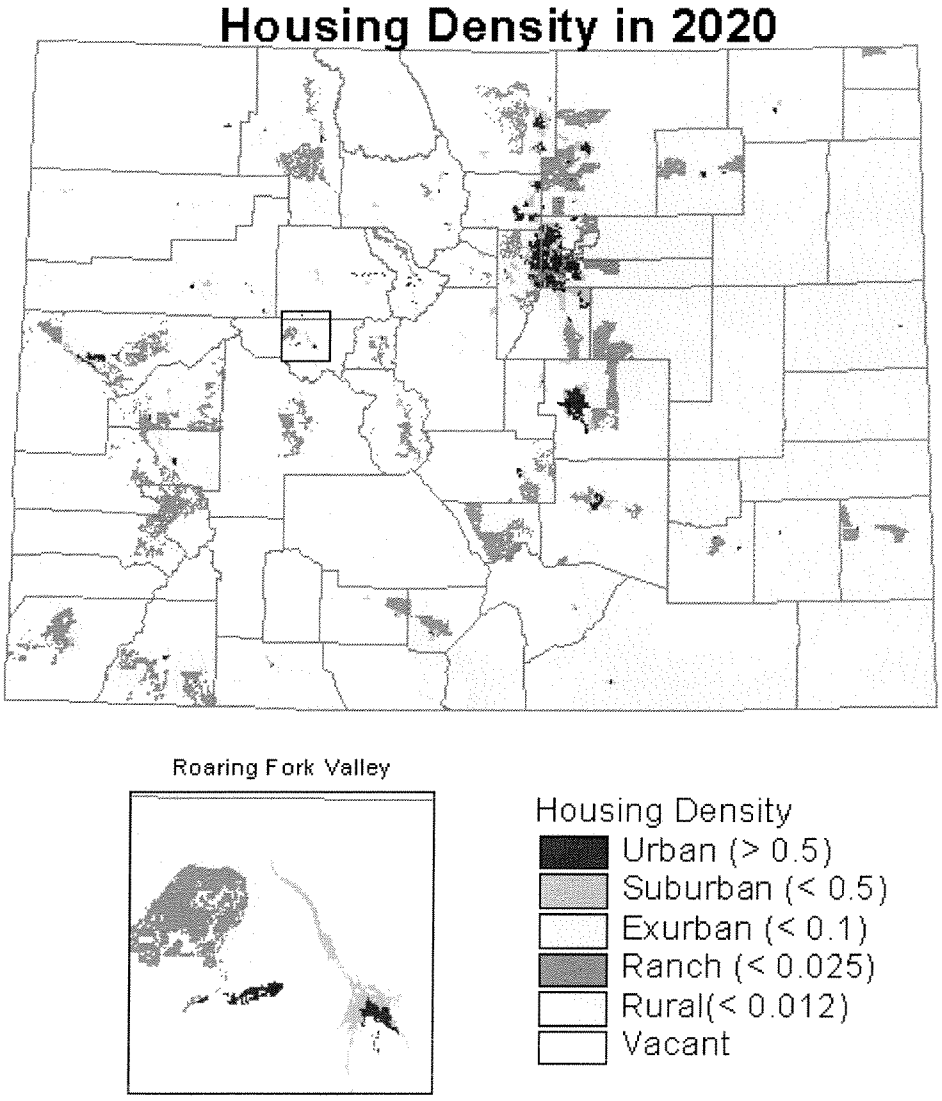


Figure 3. Projections of development density in Colorado during 2020. Projections taken from model results. The model was developed from historical data from U.S. Bureau of Census.

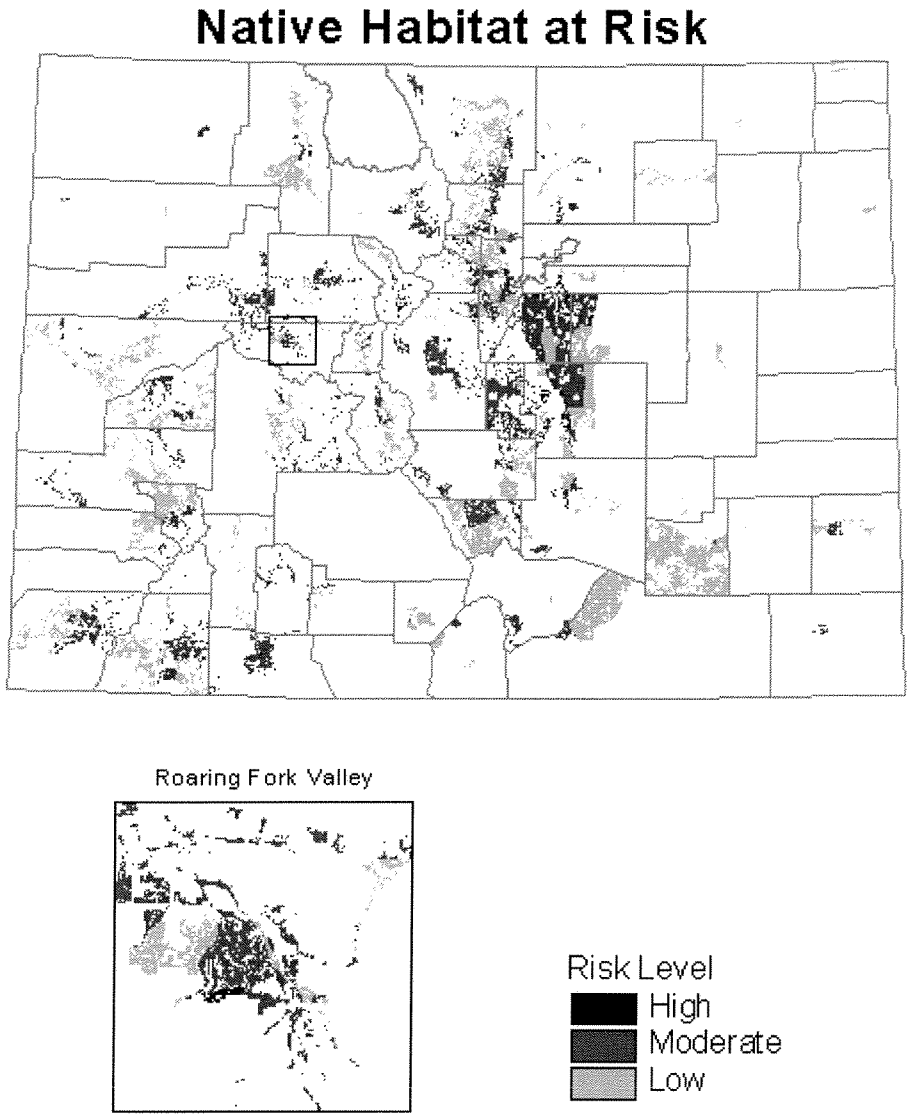


Figure 5. Projections of areas native habitat in Colorado most likely to develop during 1960-2020. Risk level is calculated by measuring the increase in housing density from 1960 to the projected density in 2020. Areas at high risk of development are those areas that in 1960 were below ranch densities but that by 2020 are projected to have either suburban or urban densities. Note that areas already developed (suburban or higher) by 1990 are removed. Areas of moderate risk of development are those areas that in 1960 were either at very low-density levels and were projected to have moderate densities by 2020, or were at moderate density levels and were projected to have high densities by 2020.