Land Use Change in the Greater Yellowstone Ecosystem

PALMS - Park Analysis of Landscapes and Monitoring Support

Importance

National Parks are designated as locations where human activities are managed to allow for protection of nature. Despite this protection, some National Parks have undergone ecological degradation including invasion by weeds and diseases and extinction of native species. An important factor contributing to this change is expanding human activity on lands surrounding National Parks. Parks are often linked to surrounding lands by movements of organisms, disturbances, nutrients, and other factors. Human land use in the surrounding lands may disrupt these flows and change ecological processes or biodiversity within the parks (Hansen and DeFries 2007). Thus, it is important to monitor trends in land use around parks and manage to mitigate any negative effects.

Status

The greater Yellowstone region was sparsely populated prior to 1900 (Fig 1). Rate of population growth increased during 1909-1920 as EuroAmericans settled in the area, slowed during the following decades and increased rapidly in the 1970s and 1990s. Area in agriculture expanded rapidly from 1900 to 1920, remained relatively constant till 1990, then decreased slightly. Rural home development has been the fastest increasing land use type in recent decades (Gude et al. 2006). This development was dramatic in the 1970s, 1990s, and during 2000-2005 (Figure 3).

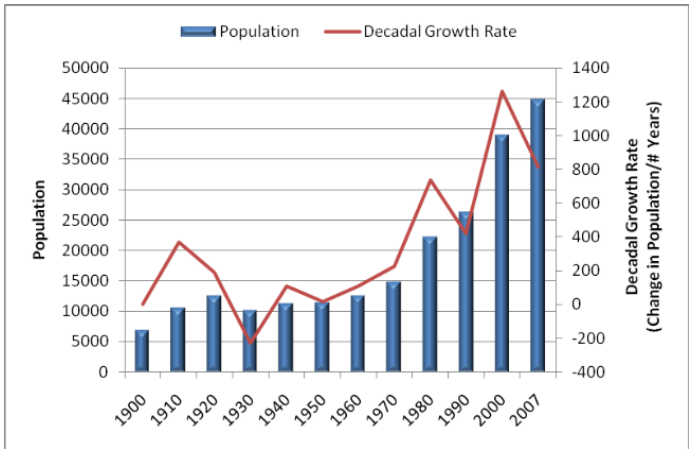

Figure 1. Change in human population size and rate of change across the Greater Yellowstone Ecosystem 1900-2007.

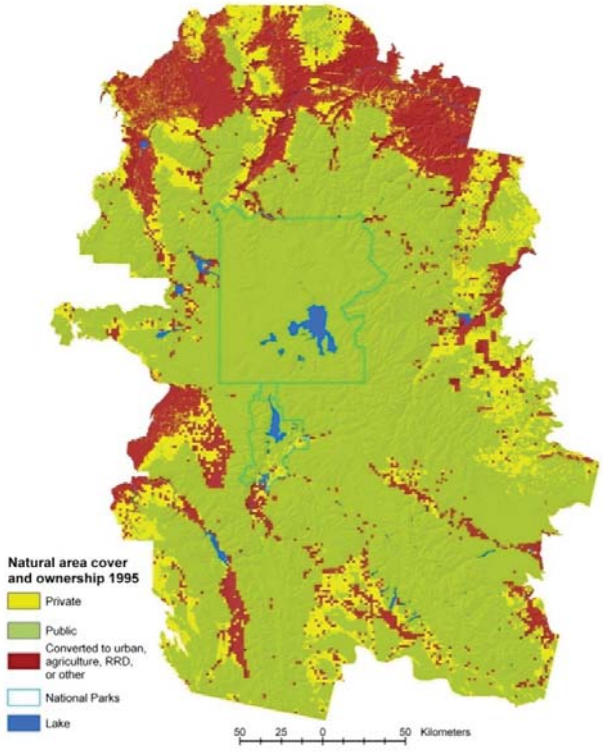

Figure 2. Distribution of public and private lands and areas converted to developed land use types across the GYE as of 1999.

Discussion

Yellowstone and Grand Teton National Parks are somewhat buffered from land use intensification by surrounding public lands (Figure 2). Private lands make up only 32% of the ecosystem. Some 43% of these private lands have been converted to agricultural, exurban, and urban land types. Thus, only 11% of the total land area in the GYE is in these more intense land use classes (Hansen 2010). This proportion is very low relative to most other US National Parks.

The private lands that are developed largely occur in the valley bottom and lower mountain slope settings that are most important to wildlife. These areas tend to have a more favorable climate, more fertile soils, higher ecological productivity, and diverse vegetation, all of result many wildlife species depending on these settings during some or all of the year (Hansen et al. 2002). Exurban development

as of 1999, for example, has impacted relatively little of higher elevation or drier habitats across the GYE such as those for moose or pronghorn antelope (Table 1) but have impacted more than 15% of riparian habitats, bird hotspots, and movement corridors (Gude et al. 2007). Projected exurban development by 2020 may impact more than 30% of these habitat types. Fortunately, many strategies are being implemented to reduce negative impacts of private land development including wildlife friendly home and ranch management strategies and use of conservation easements to reduce exurban development in the most important habitats.

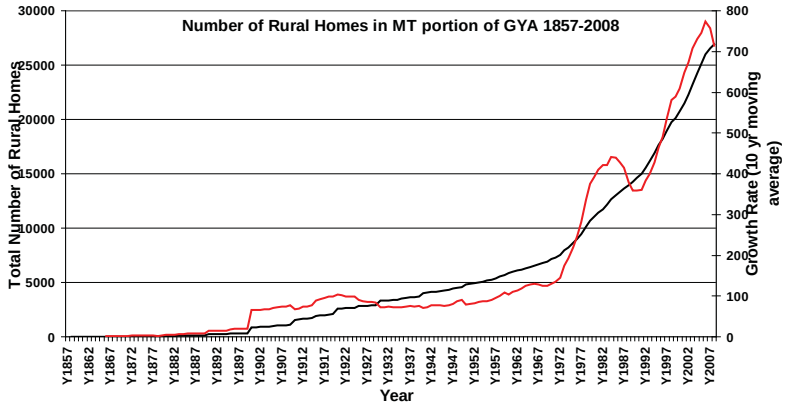

Figure 3. Number of rural homes and rates of increase in the Montana counties of the GYE during 1850-2007

Table 1. The percentage of area impacted by exurban development, defined as one home per 0.4–16.2 ha, presented for each element of biodiversity. From Gude et al. 2007.

	Percentage of habitat impacted by exurban development						
Response	1980	1999	Status quo 2020†	Low growth 2020	Boom 2020	Moderate growth management 2020	Aggressive growth management 2020
Pronghorn range	2.00	3.35	5.83	5.05	7.58	6.06	4.73
Moose range	2.73	5.49	7.96	6.83	11.11	7.24	6.26
Grasslands	2.99	5.57	8.36	7.02	11.97	8.01	6.87
Grizzly range	3.13	5.98	8.52	7.68	10.70	7.74	6.88
Douglas-fir	2.91	6.01	8.85	7.07	13.31	7.82	7.09
Elk winter range	2.36	6.26	9.98	8.61	13.47	9.00	7.23
Aspen	5.55	13.92	19.53	15.58	28.39	18.74	17.60
Bird hotspots	8.42	16.91	23.20	19.23	34.36	21.04	20.23
Riparian habitat	10.22	17.30	23.64	19.43	31.27	22.45	18.77
Corridors	8.89	18.79	24.43	20.83	35.38	22.96	21.80
Irreplaceable areas	11.41	23.15	29.61	25.69	40.08	30.88	26.92
Integrated index	11.80	23.24	29.93	25.84	40.66	29.28	26.43

Notes: Areas were considered to be impacted if they overlapped with sections containing exurban housing densities. Areas within a one-section buffer (1.61 km) of exurban housing were also considered impacted.
† Responses are ranked by the proportion impacted in the status quo 2020 scenario.

References

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Acknoweldgements

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