

Science

FINDINGS

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"Science affects the way we think together."

Lewis Thomas

SOCIETY'S CHOICES: LAND USE CHANGES, FOREST FRAGMENTATION, AND CONSERVATION



The permanency of land development makes it one of the greatest threats to private forests and the amenities they provide.

"The vast possibilities of our great future will become realities only if we make ourselves responsible for that future."

—Gifford Pinchot

One million acres per year. That's the rate at which forest land is lost to development in the United States. It often happens in fairly small bites, spread out over large areas; so, it's easy to underestimate the extent of forest loss. But you only need to fly into a major American city to gain perspective

on the sprawl of homes, shopping malls, highways, and parking lots encroaching on our forests. And unlike wildfires or logging, development is permanent. After a forest is converted to urban uses, the ecosystem services, such as water and air filtration, biodiversity protection, and carbon storage, are effectively gone.

Of course, some development is expected and necessary. Changing land use is essential for development to satisfy the needs of a growing population. The U.S. population between 1980 and 2000 grew by more than 50 million people, or 24 percent. That translates into a lot of new homes and

IN SUMMARY

Changing patterns of land use are at the heart of many environmental concerns regarding U.S. forest lands. Of all the human impacts to forests, development is one of the most significant because of the severity and permanency of the change. Concern about the effects of development on America's forests has risen sharply since the 1990s, when the conversion of forest land to developed uses reached a million acres per year nationwide. Between 1982 and 1997, there was as much private land deforested in the United States as all the forests in the state of Washington, 22 million acres.

In our market-based economy, increasing human populations and income, people's lifestyle choices and other socioeconomic factors inevitably lead to greater demands for residential, commercial, and industrial building sites, and the conversion of some forest lands to developed uses. Continued development driven by population and income growth could further fragment habitats and landscapes and reduce the amount of open space. Researchers at the PNW Research Station in Corvallis, Oregon, project more than 50 million acres of U.S. forests to be converted to developed uses, such as houses, urban areas, and infrastructure, over the next 50 years, as the U.S. population grows by more than 120 million people. Population growth is expected to be above the national average in both the South and the Pacific Northwest, two key forestry regions, and land use changes can potentially affect a wide range of market and nonmarket goods and services that forests provide.

infrastructure. But with substantial population growth ahead in coming decades, we must keep a watchful eye on the aggregate effects of land development. One million acres per year is not necessarily a crisis, but it is not sustainable indefinitely.

One concern is the effect of forest loss on water quantity and quality. Forests supply over 50 percent of the fresh water in the lower 48 States. Some 180 million people rely on forests to capture and filter their drinking water. Privately owned forests are most vulnerable to development and constitute nearly 60 percent of the total forested area in the United States. That means a significant amount of America's freshwater supply is dependent on private forests.

Not surprisingly, forest loss is greatest at the edges of cities and towns and near major transportation routes. When privately owned forest is valued more as real estate than as timberland, then it is ripe for development. The role of land economics in such decisions puts the issue squarely in the domain of Ralph Alig, a team leader and land economist at the PNW Research Station in Corvallis, Oregon. For more than 25 years, Alig has researched regional and national land economics.

Throughout that time, Alig has tracked the pace of development and watched it accelerate. In the late 1980s, his projections of unprecedented rates of development anticipated over the next two decades were viewed by some as overestimates. Looking back now, he can see that his projections were, in fact, underestimates—the booming economy of the 1990s spurred development at rates greater than anyone had predicted.

“If you look at the data we have for the period between 1982 and 1997, we had as much private land deforested in the United States



Forest loss to developed uses is greatest at the edges of cities and towns and near major transportation routes.



In the 1990s, forest loss to development reached a rate of 1 million acres per year.

as there are forests in the state of Washington, which is a very important forestry state. That's 22 million acres permanently removed from the forest land base.” In addition to the direct impact of forest conversion, forest-land development brings people closer to remaining forest lands, many in low-density development that can complicate managing forests in fire-prone landscapes.

For Alig, land use dynamics, population growth, and changing public attitudes and demands regarding forests underscore the importance of periodically updating assessments of land-cover change, as our future outlook changes correspondingly. Outside his office hangs a sign quoting the great baseball philosopher, Yogi Berra. It reads: “The future ain't what it used to be.”

REGIONAL DIFFERENCES

“Regionally, the largest increases in United States developed area between 1982 and 1997 were in the South. In fact, over one-third of the South's developed area was added during those 15 years,” explains Alig.

Indeed, 7 of the 10 states with the largest additions of developed area are in the South. The top three—Texas, Florida, and North Carolina—each added more developed area than the country's most populous state, California. The South, like the Northeast, now has approximately 12 percent of its total land area developed.

The shrinking forest land base in the South may be a threat to the future of the region's forest industry, as well as to the other

ecosystem services and amenities that forests provide. Land use pressures in the South may affect its role as an important source of timber, as more timber is currently harvested in the Southern United States than is harvested in any other country in the world.

Development trends differ widely across the United States. “In the Pacific Northwest region, for example, the population of Portland, Oregon, grew by 32 percent during the 1990s while land classified as urban grew by only 22 percent. In contrast, in

the Southeast, the population of Charlotte, North Carolina, grew by 33 percent in the same period, but its urban area increased by 44 percent. Finally, consider Pittsburgh, Pennsylvania, where population declined 5 percent and urban area increased by 1 percent,” says Alig.

“These examples illustrate that regional differences can arise not just from total population growth, but also from how that population is distributed across space,” he adds. Consider, as an example, that more

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KEY FINDINGS

- More than 50 million acres of U.S. forests are projected to be converted to developed uses (e.g., parking lots) over the next 50 years, as the U.S. population grows by more than 120 million people. In the suite of human-caused disturbances, land development is one of the most significant because of the permanency and severity of the patterns created.
- The Pacific Northwest's population is projected to increase more than the national average, expanding by more than 50 percent by 2050. This poses a considerable threat to forest lands, especially those in proximity of metropolitan areas, major transportation routes, and areas with high recreation value.
- More than 44 million acres (over 11 percent) of private forests across the lower 48 States could experience substantial increases in housing density by 2030. This is equivalent to over 1.5 million acres each year.
- Between 1982 and 1997, the amount of land deforested in the United States was equivalent in size to all the forests in the state of Washington.

than half of the United States population lives in coastal areas. Thus, coastal ecosystems face a disproportionate burden of development, with additional stresses expected from cumulative impacts. In addition, increased investments in development in coastal areas could affect more wetlands and mean increasingly valuable assets (e.g., residential and commercial structures) would be vulnerable to natural disasters such as hurricanes.

Overall, not only has the rate of development been increasing with population growth, but the amount of land developed per person has increased as well. This suggests that the country is not reducing an overall trend in sprawl, as Americans increasingly want their elbow room.

The Southwest and Southeast, for example, add some of the most developed area per

WHAT CAN WE EXPECT?

Alig and his colleagues use U.S. census data and USDA Natural Resource Inventory data to study trends in development patterns. His findings indicate that the most important drivers of land development are population and personal income.

“The urban proportion of the United States population increased steadily from 1950 to

1998, with about 80 percent of the population now living in urban areas,” says Alig. “Personal income levels, on average, have also increased substantially over the same period. Average family income increased by more than 150 percent (allowing for inflation), giving individuals far more disposable income.” About 13 percent of United

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additional resident. However, in contrast to many other regions, the amount of developed land per person in California and the Pacific Northwest has remained relatively constant since 1982.

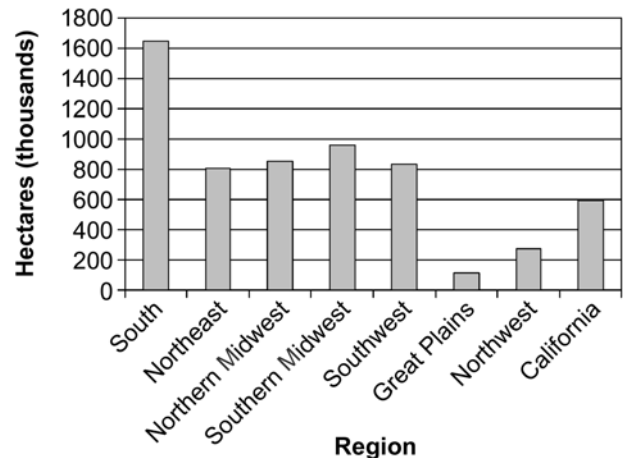
States forest land now is located in major metropolitan counties and another 17 percent in intermediate and small metropolitan counties.

Historical trends, such as these, can be used to project development patterns into the future. According to Alig, in the face of a projected 30 percent increase in U.S. population by



Property values for developed and urban uses often dwarf property values for forestry and other rural uses.

Changes in U.S. developed area by region, 1982–1997



The largest increases in U.S. developed area between 1982 and 1997 were in the South.

2030, urban and developed areas on non-federal lands are projected to increase almost 90 percent, growing from 76 million acres to 144 million acres.

The nonfederal surface area in the lower 48 States occupied by developed uses (e.g. urban and other built-up uses such as parking lots) is projected to increase from 5.2 percent in 1997 to 9.2 by 2025.

“The South and the Pacific Northwest as prime forest regions, both have a relatively large projected increase in population and a net loss in forest area,” says Alig. “The Rocky Mountain Region and some of the Midwest may have net gains in forest owing to land exchange with crops, pasture, and range uses.”

The transfer of unprofitable farmlands back to forests may continue and may help stem the net loss of forest throughout the country.

LAND MANAGEMENT IMPLICATIONS

- Increasing the density of people within private forest will likely lead to more structures in the wildland-urban interface that can complicate fire management and create more forest fragmentation, thereby increasing the importance of less fragmented public forest lands.

- Land use or ownership change may bring additional owners in proximity of national forests, including those attracted to amenities that public land provides.

- Less forest area means less wildlife habitat, more impervious surfaces, less air and water filtration, and less area on which to sequester forest carbon to address global climate change.

“It is important to consider the difference between the gross and net area converted,” says Alig. “The gross area of projected land transfer is close to an order of magnitude

higher than the net amount. Thus, many more acres change use than is suggested by the net change statistics.”

THE VALUABLE AND INVALUABLE

Land use change is a zero sum game. There is simply no new source of land entering into the equation. It follows then, that “if relative demands continue to increase for other land uses, forest area is likely to continue to decline and affect a broad suite of ecosystem conditions and services,” says Alig.

To predict which forests are most likely to be lost first, Alig utilizes an economic concept developed in the 19th century—land rent theory. According to this theory, land is likely to be developed based on its greatest

value among all competing uses. A private landowner is assumed to choose to develop land when the developed value rises above the rural land value, if allowed by zoning or other regulations.

“The research shows that forests closest to currently developed areas or infrastructure have higher values and are more likely to be developed. For example, our research in northwest Washington found that private forest-land value decreased as you got farther away from the interstate. So, the converse is that forests near the interstate were valued

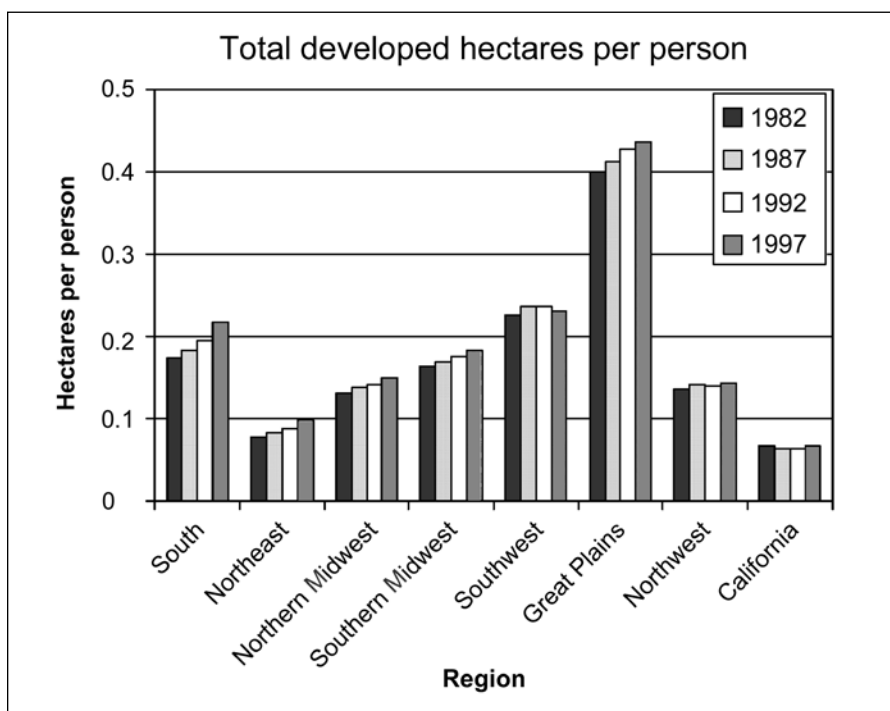
for other uses that are dependent on the road system; those forests will likely be converted first,” explains Alig.

“The ability to retain land in forest cover is dependent, in part, on how individuals value the uses of undeveloped forests as compared to other uses of the land, such as residential and commercial development,” he adds. The matter is complicated by the fact that many social values, such as ecological, scenic, recreation, and resource protection, are not typically reflected in market prices for land.

Property values for developed and urban uses often dwarf property values for forestry and other rural uses. This is certainly the case for forests in proximity to metropolitan areas or areas with high recreation value. This increases the opportunity costs of retaining undeveloped forests and also means that any financial incentives by governments to promote retention of forest land, such as tax incentives or subsidies, need to increase in the face of rising costs of not developing.

Within the last decade, large blocks of forest industry land have been sold, increasing the likelihood that some forests could be converted to the “highest and best use” and thereby developed and fragmented. Some forest products firms are selling gated forest communities, with 20- to 40-acre parcels, resulting in both physical fragmentation and more owners.

“This has implications for policymakers concerned with both public and private forests and aquatic ecosystems and how to maintain them in the face of a growing population,” says Alig.



Americans increasingly like their elbow room.

A SOCIAL CHOICE

“Forest development and fragmentation is a social issue. Human actions cause these changes. Human choices will decide what if any responses from a social viewpoint are appropriate, with quality of life considerations,” says Alig. “Economics can help identify more efficient land allocation choices, considering both financial and non-financial elements. For example, if economic efficiency is an important consideration in policy deliberations, then the desired ecological measure of forest fragmentation should be made explicit. Considering all the social costs and benefits of land use changes leading to forest fragmentation could help improve land allocation from society’s viewpoint.”

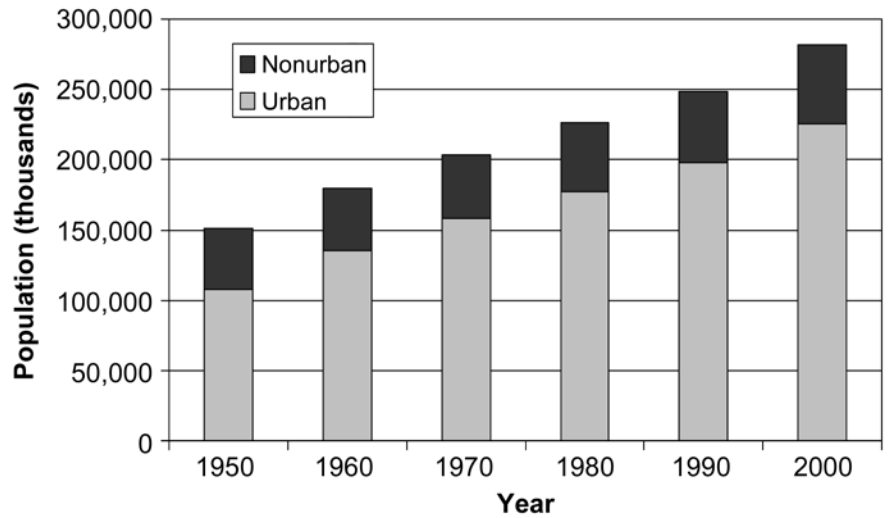
Alig’s reconstructions and projections provide information for use in long-term policy deliberations about land conservation. Although the statistics may seem a little grim sometimes, Alig remains objective. His role is to provide the findings to policymakers, whose job it is to make the policy decisions pertaining to land use.

One way that the Forest Service is responding to projections of future forest loss is through the Forest Legacy Program. This program identifies at-risk privately-owned forests having important ecological values and ecosystem services. The Forest Service and state cooperators then try to collaborate with the owner to purchase a conservation easement, which buys the right to develop the land without actually transferring ownership. The landowner keeps their property and agrees to keep it in forest uses. The challenge for the Forest Legacy Program will be identifying and conserving the most important forest land before the value of that land in developed uses becomes prohibitively high.

Another recent example of his findings being used to inform policymakers can be found within the 2005 update of the national Resources Planning Act Assessment of the Forest and Rangeland Situation in the United States. The land use modeling is a core activity that provides information to multiple specialists dealing with future water supplies, recreation, wildlife habitat, and other natural resource situations.

Even as an objective documentarian of change, Alig does have some perspective on the future of forest and land conservation. He

Urban and nonurban population in the United States, 1950–2000



The urban proportion of the U.S. population increased steadily from 1950 to 1998, with about 80 percent of the population now living in urban areas

believes that by taking a holistic approach to policy formulation, we can more efficiently conserve forest land. “We need to think about weaving all the forest issues together, take a mixed-ownership perspective, and consider links to the rest of the global economy and environment. How can we effectively keep more trees to sequester carbon to address climate change, protect wildlife habitat, provide open space, reduce forest fragmentation, and provide for continued population and economic growth? I think that, on the policy front, we will be more effective if we consider these multiple issues in a coordinated fashion,” he says.

A more integrated approach to forest conservation will likely be necessary as we move into an uncertain future, along with changing attitudes about land and the forest ecosystems that they support. The importance of forests in environmental, economic, and social terms warrants increased attention by society.

“The oldest task in human history: To live on a piece of land without spoiling it.”

—Aldo Leopold

FOR FURTHER READING

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For more than 25 years, he has continued that research, and has developed land use and land cover models that have been applied in policy analyses involving timber supply, wildlife habitat, global change, and conservation programs. He is the USDA Forest Service's national coordinator for projections of land use changes for Resource Planning Act assessments and also has helped develop a national model of land allocation for the forestry and agriculture sectors.

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