PNW
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Research Station

Science
FINDINGS

INSIDE

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"Science affects the way we think together."
Lewis Thomas

TREES, HOUSES, AND HABITAT: PRIVATE FORESTS AT THE WILDLAND-URBAN INTERFACE

Urban residents are increasingly moving into rural settings seeking an improved quality of life.

"Things alter for the worse spontaneously, if they be not altered for the better designedly."
— Francis Bacon

Hobby farms, trophy homes, wildland-urban interface, sprawl—these new terms in our popular vernacular all relate to the emigration of urbanites into rural landscapes. Whether this is a problem, an inevitability, or a sign of prosperity is a matter of perspective; but regardless, it is happening, and it is a trend that communities and governments often try to anticipate and even plan for rather than being surprised by.

In western Oregon, where forestry has been part of the cultural identity for generations, rural communities worry that population growth and forest land development could fragment the landscape and lifestyle that they are accustomed to. And they have good reason to believe that change is afoot. Throughout the United States rural areas increasingly are attracting city-dwellers seeking a better quality of life. These newcomers tend to bring different perspectives on forests that tend to value aesthetics and recreation over timber production.

Not surprisingly, the Oregon Department of Forestry (ODF) has an interest in such trends. It would like to see forest lands stay forested and Oregonians stay engaged in forestry. Oregon implemented its landmark comprehensive land use laws, in part, to protect forest land.

IN SUMMARY

How population growth and development affect forests is a shared concern among forest managers, policymakers, land use planners, and fish and wildlife specialists. Of particular interest is the "wildland-urban interface." It is characterized by expansion of residential and other developed land uses onto forest landscapes in a manner that threatens the ecological and socioeconomic value of forests.

Oregon has experienced gradual but steady population growth for several years, with most growth occurring in urban areas. However, some development has taken place in more rural, forest settings. Forest land development can bring changes to forestry activities, such as timber harvesting and management, as well as to the ecological characteristics of forests. The Oregon Department of Forestry and the PNW Research Station formed a research partnership to investigate these changes in western Oregon.

Their findings suggest that despite population growth, rates of development have slowed during the past two decades. However, where low-density development has occurred, new residents do appear less inclined to manage their forest lands for commercial timber production. Although the likelihood of harvesting remained unchanged, increasing building densities were correlated with lower forestry investment. Projections indicate that some forest land development will continue, but most will be focused around existing urban areas and along major transportation routes.

"Just how fast are forest lands being developed in western Oregon? Is population growth having any effect on private forests and forestry? Are the people that are building houses in forest landscapes continuing to manage their lands?" Dave Azuma asks rhetorically. "These are some of the questions ODF approached us with."

Azuma is a research forester with the Forest Inventory and Analysis (FIA) program in the Pacific Northwest (PNW) Research Station in Portland, Oregon. The FIA Program is the census agency for the Nation's forests. It is the FIA program's job to periodically remeasure a network of forested plots dispersed throughout the country. They maintain a vast database that describes the extent and condition of American forests, uniquely suiting them to address ODF's questions.

"Using aerial photos and ground data, we interpreted about 24,000 photo-plots on privately-owned land. We gathered detailed information about the dominant land use, number of buildings, and nearest distance to other dominant uses. We also characterized the status of the forest for associated ground plots, including any evidence of forest management," explains Azuma. "We repeated this process for data acquired in 1973, 1982, 1994, and 2000."

KEY FINDINGS

- Low-density development of private forest lands in western Oregon is accompanied by reduced forest management and investment on those lands. Although harvest likelihood remains unchanged, increased building densities lead to lower rates of precommercial thinning and tree planting following harvest.
- Although only a small proportion of forest land in western Oregon currently is affected by rural development, population growth projections suggest that potential impacts on active forestry could be greater in the future.
- Projections suggest that by 2024, more than 100,000 acres of additional forest land in western Oregon will be developed at low densities, while more than 35,000 acres will be converted to urban. Projections imply that increasing numbers of people will be located on existing forest landscapes.

These data described private forests and forestry over a timeframe in which the population in Oregon increased by more than 50 percent—from 2 million in 1970 to 3.3 million in 2000.

This was a unique and valuable dataset; one that Jeff Kline and his team could not have assembled without collaborating with the FIA program.

The "team" is the Land Use and Land Cover Dynamics team with the PNW Research Station in Corvallis, Oregon, where Kline is a research forester. He and his colleagues have the analytical prowess to unravel FIA's massive datasets and to develop empirical models that can describe patterns of urban and rural development, forest stocking, thinning, harvest, and tree planting.

In partnership, the Oregon Department of Forestry, the Forest Inventory and Analysis program, and the Land Use and Land Cover Dynamics team have examined the issues of population growth and development, and their effects on forest land in western Oregon.

Their results are nuanced and include both the expected and unexpected.

UNRAVELING LANDOWNER BEHAVIOR

Once people and their land management intentions are involved, things get complicated. A variety of socioeconomic and environmental factors influence the behavior of nonindustrial private forest owners—a group that tends to have diverse objectives regarding how they manage their forest lands. Many base their forest management decisions on nontimber values, such as aesthetics, wildlife, and recreation, in addition to, or in place of, timber production, causing them to respond to economic conditions in complex and sometimes unpredictable ways.

"There is a body of research, mostly from the Southeastern United States, that suggests that nonindustrial private owners are less likely to manage and harvest timber as tract size decreases, because small parcels tend to be more costly to manage than large ones. Moreover, we suspect that many newer forest land owners, those recently building houses on forest land, probably give greater weight to nontimber values," says Kline.

As populations increase, forest land is profitably subdivided, reducing the average size of remaining parcels and bringing new forest land owners to rural areas. Conventional wisdom would predict that population growth of the magnitude experienced in Oregon over the past two decades, would be accompanied by reductions in active forest management and harvesting.

Conventional wisdom, as usual, misses the complex reality.

"The likelihood of harvesting has not varied due to population growth and urban expansion since 1974," says Azuma. "The results imply that when there is standing merchantable timber, private forest owners in western Oregon have tended to harvest that timber."

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But that is not the whole story. Although the rate of harvest has not changed, the way forests are managed has. Nonindustrial private forest owners in locations where development has taken place now tend to be less likely to plant and actively manage forests after they harvest, and they are less likely to thin young forests to promote future growth.

"Those particular results did confirm the Department of Forestry's guess that population growth and forest development were having an impact on forestry," says Kline. "From an economic perspective, reduced private investment in forestry after harvest and lower forest productivity could lead to lower quantities of timber supplied from private forest lands in the future."

"However," Kline continues, "It is also possible that continued growth and development might increase land prices to a point where commercial timber production will not be economically viable in more populated areas anyway."

Residential development and reduced investment in forestry may bring about other unforeseen changes, which may be at least as important as lower timber production.

"Development will undoubtedly have some ecological consequences as some forest lands are converted to residential and other developed uses." explains Kline. "Resulting fragmentation of forest vegetation, coupled with reduced management of remaining forest lands, could change ecological characteristics in unexpected ways as well, adversely affecting habitat for some species while improving habitat for others. We can't assume the effects will all be negative."

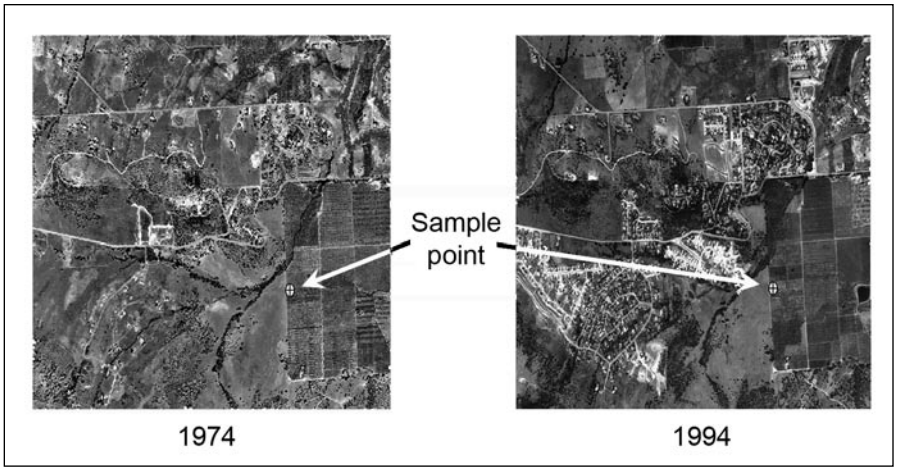

Figure 1—Aerial photos of land use change.

"Also, as new homes are built within the forest, there is an increased risk that wildfire may cause property damage," he adds. "In these areas the forest landscape is changing, and presenting many new challenges. Managers and policymakers may want to focus less on how development is affecting production forestry, and more on fostering new forms of stewardship."


When new homes are constructed in forest lands, the potential loss from wildfire increases.

TRACKING THE PACE OF DEVELOPMENT

Yes, people are moving into forests, but is the Oregon countryside being saturated with commuters and second homes? Not by a long shot.

"Much of the private forest and agricultural land in western Oregon remains sparsely populated," explains Kline. "We found that only a small proportion of all forest land in western Oregon is located in places where significant development has occurred."

After all, this is Oregon, a state of steep mountains and expansive forests. "Despite recent population growth, the average population density is still a lot less than in other parts of the country," says Kline.

Furthermore, and contrary to what one might expect, the rate of forest land development has slowed throughout the study period—this, in the face of population growth and personal income gains.

"It is likely that some of the slow-down in forest development is a result of Oregon's comprehensive land use laws," says Azuma.

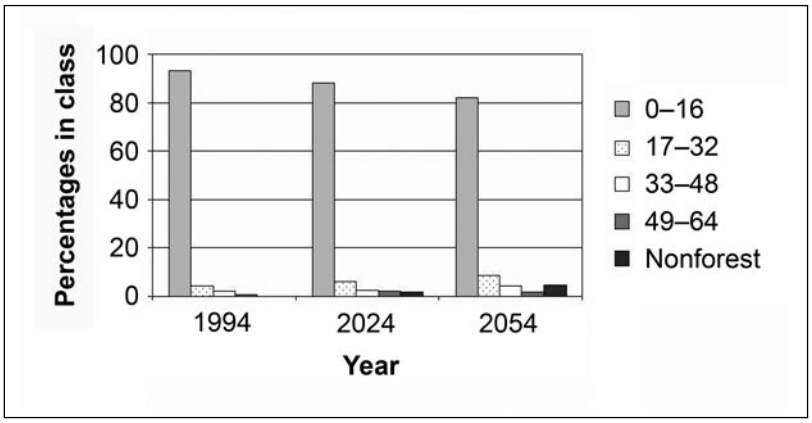

Figure 2—Predicted privately owned forest land by buildings per squre mile in western Oregon, 1994 to 2054.

"The data certainly suggest it. That is something we have been looking at."

In the most recent period, from 1994 to 2000, the annual rate of conversion was less than 1,000 acres. Compare this with data from 1973 to 1982 when each year approximately 11,000 acres of wildland forests were converted to a different use—predominantly to residential.

More than 80 percent of land use changes from 1973 to 2000 were shifts from agriculture or forest to low-density residential or

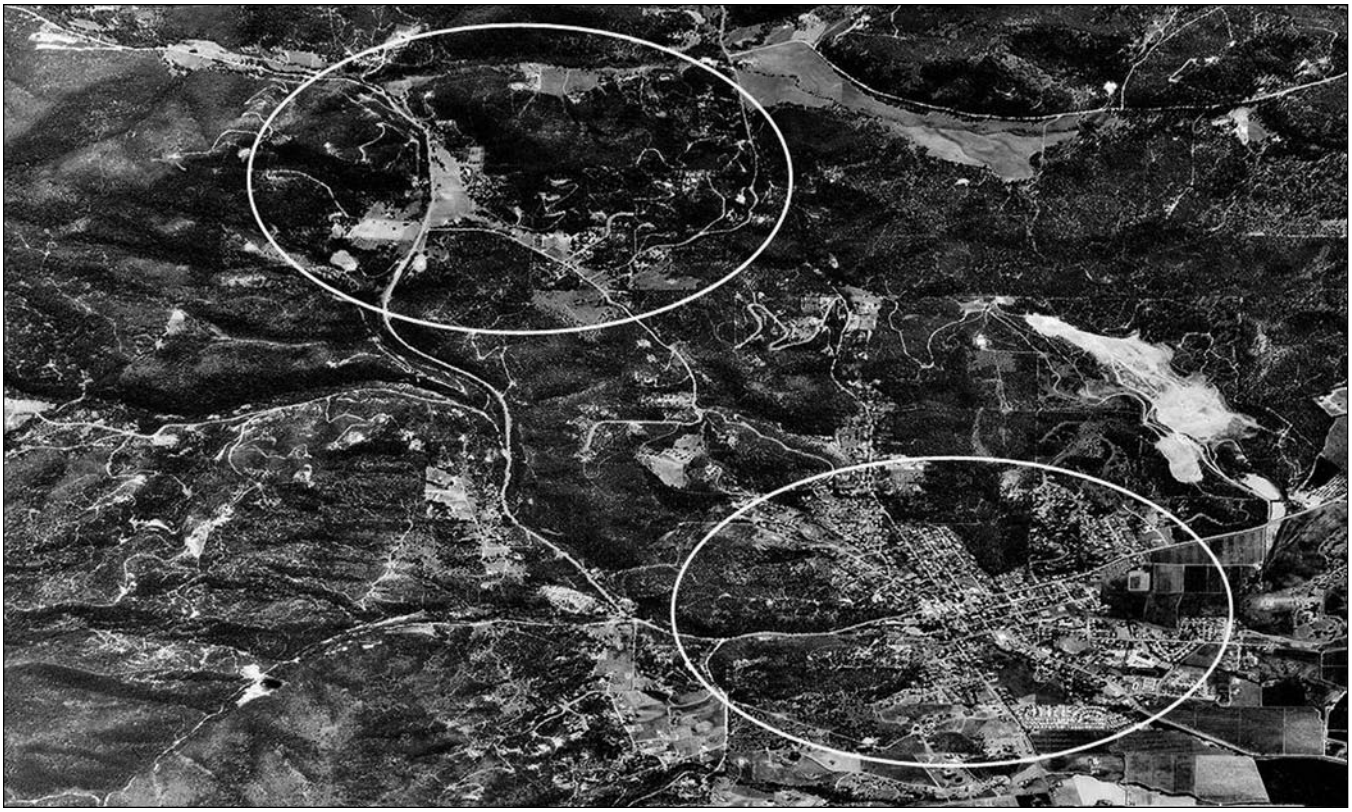

Figure 3—Example of low density and urban zones.

urban; the largest declines in active resource use occurred in agriculture.

The closer forest land was to an urban or residential area, the more likely it was to be developed. "For example, forest and agricultural areas less than one-quarter mile from a low-density residential area were five to ten times more likely to be developed than areas further than a mile from a residential area," explains Azuma.

Not surprisingly, private lands in the Willamette Valley and areas closest to the Portland Metropolitan Area were most affected.

"One thing to keep in mind is that development is probably still unlikely to affect a large proportion of forest land," says Kline. "Forest lands with steep slopes and those that are isolated from existing populations were unlikely to develop even before land use zoning."

Their findings do not imply that development on forest landscapes should no longer be of interest to managers and policymakers. On the contrary, Azuma and Kline note that population growth rates projected for western Oregon suggest that greater change could be forthcoming.

WITH AN EYE TO THE FUTURE

After examining historical development patterns, Kline and Azuma shifted their focus to the future. By projecting trends forward, they were able to predict the potential effects of population growth on the region's forest lands over the next several decades.

"By incorporating data describing the topographic features and land use zoning, we were able to predict potential future land development in terms of the numbers and locations of new buildings," explains Kline.

It is a unique approach to predicting future land use change and it is made possible by the building-count data collected by the FIA program.

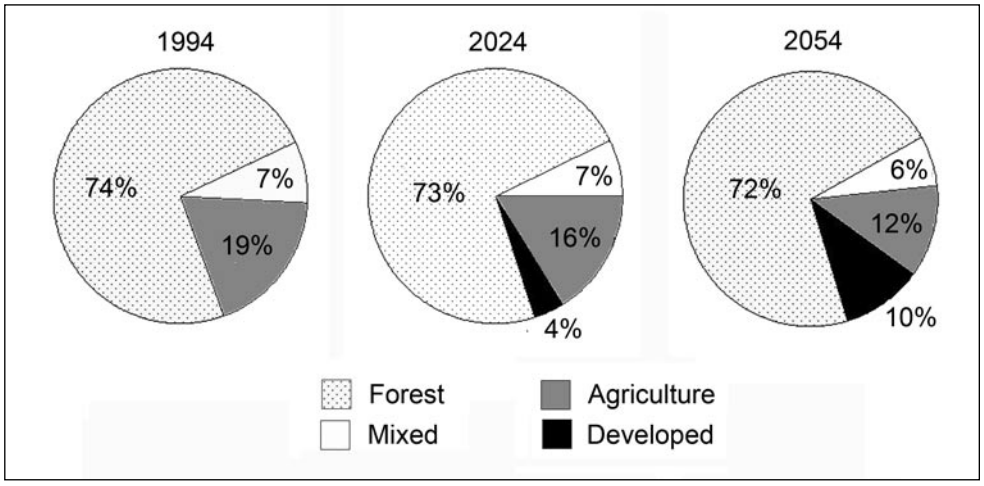

Figure 4—Predicted composition of 1994 private forest and farmland in western Oregon by 2024 and 2054. Developed land is defined as having more than 64 buildings per square mile.

Just what does their analysis predict?

First, some context. In 1994, western Oregon had 7.2 million acres of nonfederal forest land, of which approximately 1 percent was developed at relatively low densities of 64 to 640 buildings per square mile. Land exceeding 640 buildings per square mile, or one building per acre, is considered urban.

Projections suggest that, in 20 years, an additional 1.5 percent of the region's forest land will be developed at low densities, while 0.5 percent will be converted to urban. Within 50 years, another 2 percent will be developed at low densities, and 1.5 percent will be converted to urban.

Perhaps the most exceptional part of these projections cannot be adequately represented in this summary. Computer simulations can display a map of western Oregon with several amoeba-shaped blobs and clustered red speckles, all growing over time.

LAND MANAGEMENT IMPLICATIONS

- State land management agencies can use the analysis of development to evaluate development effects on forestry, and the effectiveness of land use zoning laws in maintaining forest productivity on private lands.
- The projections can be used by public agencies and private firms that are seeking a reliable indicator of future land use change and development, such as in evaluating the likely impacts of land use changes on fish and wildlife habitat in specific locations and watersheds in western Oregon.
- Managers can use the projections of new building construction to anticipate regions likely to have an increased danger of property damage resulting from wildfires.

The blobs are urban areas, such as Portland and Eugene, pushing outward into the adjacent forest lands. The clustered speckles are nonindustrial private lands, mostly in valley bottoms along major road networks. These are the areas most likely to undergo land use changes during the not so distant future.

The spatial nature of their analysis makes it broadly applicable to anyone interested in the future of the western Oregon landscape.

DIVERSE APPLICATIONS FOR LAND USE PROJECTIONS

Strictly speaking, Kline is an economist. But he has broad research interests, and his land use projections are valued across many disciplines.

He has helped apply the projections to the needs of a variety of public agencies and private firms seeking a reliable indicator of land use change and development. A common use is evaluating the likely impacts of forest and farmland development on wildlife habitat in specific locations or watersheds.

"An interest in the ways that forested landscapes will change over time is something that we share with landscape ecologists and forest policy analysts," says Kline. "Therefore, it was natural that we found opportunities to integrate our land use projections with ecological information to evaluate the potential consequences of forest policies for fish and wildlife."

Kline and his colleagues combined those interests within the Coastal Landscape Analysis and Modeling Study (CLAMS). The CLAMS is a multidisciplinary research group dedicated to understanding the aggregate social, economic, and ecological impacts of future changes in policy in the Oregon Coast Range. Kline and Azuma's research is fundamental to the CLAMS agenda.

"Our portion of the CLAMS analysis characterizes the spatial distribution of humans on the landscape in terms of building densities, which serves as input into other models describing timber production and wildlife habitat," explains Kline.

The CLAMS scientists can then examine alternative scenarios for future Coast Range forests under plausible policy frameworks. For example, CLAMS scientists can simulate, in great spatial detail, the likely impacts of changes in the Oregon Forest Practices Act, or in the Northwest Forest Plan.

"Use of the development projections by CLAMS is a good example of the 'integrated-across-disciplines' types of analyses made possible by this research," says Kline.

"Attitudes about land and the earth-oriented resources on which we depend for our environment and livelihood vary with the intimacy and urgency of our dependence upon them."

—Raleigh Barlowe

FOR FURTHER READING

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