

Science

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“Science affects the way we think together.”

Lewis Thomas

WHERE WILL THEY ALL LIVE? THE ENDURING PUZZLE OF LAND USE CHANGE



▲ Land use planning in Oregon has accelerated development of forest and farm lands within designated urban-growth boundaries.

“If a man will begin with certainties, he shall end in doubts; but if he will be content to begin with doubts, he shall end in certainties.”

Francis Bacon 1561-1626

The common belief is that Oregon's Comprehensive Land Use Planning legislation has seemingly achieved its goals. Since 1986, all counties have had a comprehensive plan in place, the rate of development of farm and forest land seems to have slowed, and urban growth has largely been contained within designated areas.

Oregon has come to be regarded as the pinnacle of land use planning, government intervention at its best, its model used across the country by other states tackling gnarly development issues. Urbanization and its associated problems have become “hot” 21st century issues, and Oregon, it seems, has found the solution.

Really?

“In truth, the data may not yet exist to show whether Oregon's land use laws are actually working fully as intended,” says Jeff Kline. “The problem in Oregon is that the changes in land use are small compared with the amount of land available, thereby making growth a rather slow process, contrary to perceptions. Thus it's hard at this point to test the real effectiveness of the land use laws.”

I N S U M M A R Y

A concern among land managers is land use. Who is using the land? What is it being used for? Is the amount of farm and forest land lost to development really increasing? Research forester and economist Jeff Kline and research forester Ralph Alig at the PNW Research Station are conducting studies to answer questions about land development in western Oregon and Washington.



A key finding of that research includes that projections of land use through 2050 indicate an increase in urban lands of 31.5 percent in western Oregon and 34.4 percent in western Washington. Potential reduction in the area of forest land in these two areas is 1.7 and 2.4 percent, respectively, and in farm land, 4.5 and 14.9 percent, respectively.

Kline and Alig use an empirical model to help define and project land use change. Tension will probably always exist among people of opposing viewpoints about land use. Perhaps this research will assist in moving people toward defining and developing the types of communities in which they will want to live in the future.

Don't misunderstand Kline. He is not advocating that the planning laws should be abandoned. He does think, however, that they should be closely monitored, over a longer period, before we can safely say they have achieved their goal of reducing the amount of farm and forest land being lost to development.

Kline is a research forester and economist with the PNW Research Station in Corvallis, Oregon, where he and research forester Ralph Alig have used models to project land use change for the Resource Planning Act (RPA) assessment. Kline also has been investigating the impact of land use planning on development. Previous studies, he notes, have relied on anecdotal evidence rather than data describing actual land use change.

"Call me a cynic, but I tend to believe that if someone has a quick success story, there's usually a far more complex story underneath it."


KEY FINDINGS


- Projections of land use through 2050 indicate an increase in urban lands of 31.5 percent in western Oregon and 34.4 percent in western Washington. Potential reduction in the area of forest land in these two areas is 1.7 and 2.4 percent, respectively, and in farm land, 4.5 and 14.9 percent, respectively.

- Projections of timberland reductions through 2050 suggest 0.2 percent in industry-owned land in the West. Timberland owned by nonindustrial private owners is expected to decrease to 3.8 percent in western Oregon and 6.7 percent in western Washington.

- Oregon's land use planning program may have accelerated the pace of development of forest and farm lands inside urban growth boundaries but has not measurably reduced development, or its likelihood, outside urban growth boundaries and within forest and farm use zones.

- Lands with highest development potential tend to be located near larger or rapidly growing cities and are often farm lands. Lower development potential is found among lands further away from urban centers; these often coincide with forest lands.

MODELING THE REAL WORLD

Kline grew up in the rolling hills of southeast Pennsylvania, where the once pastoral scenery has been significantly diminished by urban sprawl, and watched much of New Jersey disappear under the same conceptual bulldozer. This background influences his current research, helping him see "slow" growth rates where Oregonians already perceive that condos are taking over. It also has given him a sneak preview of what the Willamette Valley, for example, might look like in 20 or 30 years, when it could have land use patterns similar to those of New Jersey superimposed on it.

The history of Oregon and other Western states is steeped in the use and overuse of resource lands. The protection of these lands has become an increasingly important goal of public officials, environmentalists, and rural communities. Concerns about preserving their productive value have now been joined by concerns about reduced congestion, environmental protection, and outdoor recreation, all of which contribute to quality of life for both urban and rural residents.

Some areas have responded directly to development challenges with open space and farm land preservation programs. Oregon chose the more indirect approach of regulating the pace, location, and character of development through the Land Conservation and Development Act enacted in 1973 and implemented state-wide by 1986.

"Although the success of preservation programs can be measured by the area of forests or farm land preserved, evaluating the success of a land use planning program requires comparing existing land use to that which would have occurred without such a program," Kline says.

So how does he tackle the challenge of previewing the future and second-guessing the past?

Several types of models are available to project land use change. Kline questions what he calls the simulation method as being too simplistic and utopian. This kind of model looks simply at what land use laws allow and applies increasing population

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densities to see what happens. Allocating future populations to existing or planned zoning scenarios does not allow for unexpected changes in overall laws or urban growth boundaries, or for human failings in allowing exceptions, Kline points out.

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"Economic forces and physical land characteristics ultimately determine where land use change will occur. To a great extent, zoning simply tends to reflect these trends," he says.

"My preference is to let the data dictate by using an empirical model that first takes historical land use, including population density and zoning laws, and projects it as a set of probabilities into the future. Then we can incrementally add other economic factors such as forest and agricultural land rents, income, where growth is occurring, and landowner characteristics, to get a more realistic picture."

Our empirical model assumes, for example, that land use change is motivated by landowners who want to maximize their wealth.

THE OREGON STORY

To evaluate the effects of land use planning, Kline used the empirical model to describe the probability that forest and farm land in western Oregon and western Washington were developed to residential, commercial, or industrial uses, before and after Oregon's land use planning took effect. (Washington, by comparison, had no similar legislation during the period analyzed.) Land use data came from the USDA Forest Service's Forest Inventory and Analysis (FIA) program.

Forest Inventory and Analysis program data are gathered by using photo-interpretation and ground-truthing. In other words, they are systematically sampled plots defined photographically as a pinpoint on the ground, then cross-checked with what is actually on the ground. The data include land use and ownership characteristics. Although they tend to focus on forest lands, they do provide observations of agricultural and developed land uses as well.

Results from the models suggest that Oregon's land use program has tended to concentrate the conversion of resource lands to developed uses within urban growth boundaries, Kline notes. Urban growth boundaries are the lines drawn around cities, which are supposed to contain urban growth within their confines, thus limiting the sprawl that can so easily

LAND MANAGEMENT IMPLICATIONS

- Statewide land use zoning such as Oregon's may alter the patterns of development to some degree but may be inadequate to protect forest and farm lands in the long run.
- Projected land use coverages identify for researchers and policymakers those forest and farm lands most at risk of conversion to urban uses. This information can help shape county- and local-level land use programs and policies concerning the protection of forest and farm lands.
- Projected land use coverages can be combined with knowledge and analysis of ecological processes to evaluate the impact of land use change on ecological health.



▲ Both before and after land use planning, agricultural lands distant from urban or residential areas were less likely to be developed.

eat up farm and forest (resource) lands. Resource lands are protected by "exclusive use" zones, which can only be breached by specified exceptions.

Kline and Alig's projections of land use through the next 50 years for the RPA indicate potential reductions in forest land area of 1.7 percent in western Oregon, and 2.4 percent in western Washington. Farm land reductions are 4.5 percent in western Oregon and 14.9 percent in western Washington. By contrast, the area of urban land is projected to increase by 31.5 percent in western Oregon and 34.4 percent in western Washington.

Kline says his analysis suggests that land use planning has accelerated development of forest and farm land within urban growth boundaries, as presumably intended by the laws. The highest development potential occurs near larger or rapidly growing cities, such as Portland, Salem, Eugene, or within corridors between these cities.

"However, the results also suggest that the likelihood of conversion of resource lands to developed uses has not been measurably different for lands located outside of urban growth boundaries and within forest use and exclusive farm use zones," he says.

WRITER'S PROFILE

Sally Duncan is a science communications planner and writer specializing in forest resource issues. She lives in Corvallis, Oregon.

IS LAND USE PLANNING WORKING?

Knowing that this finding is somewhat controversial, he hypothesizes three possible explanations for this apparent challenge to the successful image of Oregon's land use planning laws.

First, the land use planning program may not have succeeded in slowing these land use conversions after all. The development of hobby farms, and similar holdings within forest zones for hunting lodges or second homes, could constitute a "leakage" from existing urban growth boundaries that is no less real for being low density. Kline notes, however, that existing land use data do not provide sufficient detail regarding development density to test this theory.

The second possibility is that Kline's analysis recognizes land converted by commercial forest owners and farmers for personal residences as actual development, whereas the state does not count these as developed uses. Forest Inventory and Analysis data make this distinction difficult, and thus Kline's model "sees" more development in farm and forest lands than the state does.

The third possibility is that the land use laws simply institutionalized something that was already happening: resource lands

located within urban growth boundaries have always been more likely to be developed than those located further from urban areas.

"It is plausible that little change is observed in the likelihood of development outside urban growth boundaries and within forest- and farm-land exclusive-use zones simply because so little development had been taking place there before the land use laws," he says. "Thus we are unable to detect a statistically significant change in the likelihood of development since the law was enacted."

The difficulty in going beyond these conclusions, he says, is largely a data problem.

"Few sources provide a comprehensive and consistent depiction of historical land use change. Tradeoffs often must be made between data quality, coverage through time, and the ability to merge land use data with available socioeconomic and other data."

The growing use of remote-sensed data, from satellite imagery and aerial photos, with geographic information systems to display them visually, may offer a more

detailed, comprehensive, and consistent view of land use change. Still, satellite imagery is often limited in its timeframes, and aerial photos are expensive to digitize. Also finding statistically reliable data across multiple periods, particularly in digitized form, is not always easy.

Kline says that a new land use data set recently developed by the PNW Research Station Forest Inventory and Analysis program may help. Developed with assistance from the Oregon Departments of Agriculture, Forestry, and Land Conservation and Development, the new data provide a more detailed picture of land use change than what was previously available.

"Preliminary analysis (by Azuma and others 1999) suggests there may be some slowing of land use change from forest and farm land to urban uses. Additional analysis, however, is needed to determine if this slowing is due to Oregon's land use law or to relatively lower rates of population growth among other factors. We are looking closely at this data and hope to have some answers within a year," Kline says.

INTEGRATING ECOLOGY AND ECONOMICS

Socioeconomic data, he notes, are almost always at a coarse scale, such as county or census tracts, and economists often are left with prices and income as the only solid data they can collect. Alig was a pioneer in modeling land use with coarse data, and such models will be used in RPA assessments nationwide.

"In contrast, land use models at county levels are barely seen as relevant by some ecologists, with whom we now work on some projects to try to integrate ecological health and economic development. We constantly face the challenge of how to explain human behavior at a finer scale."

Another quirk of working with economists, is that they tend to "streamline" their approaches to problems, no doubt as a product of the way they are trained to think: We have this data set and that model, is it efficient and effective to use them together? Thus their approach is generally

to begin with a simple model and build in greater complexity and more variables only if they think the potential gain is worth the effort, Kline says. In contrast, ecologists are more likely to take on the entire complexity of the ecosystem and let the process take as long as it needs to unfold.

The output of such collaboration is increasingly in the form of spatially explicit or map-based, models with which to examine and project land use change. "Although standard practice regarding such models is still evolving, most try to describe the conversion of nonurban land to urban uses by combining population density and proximity to roads, markets, and population centers," he says.

The need to learn each other's language and thinking styles has been highlighted in the coastal landscape analysis and modeling study (CLAMS), which seeks to evaluate possible futures in Oregon's Coast Range,

including land use change, timber supply, ecosystem health, and more.

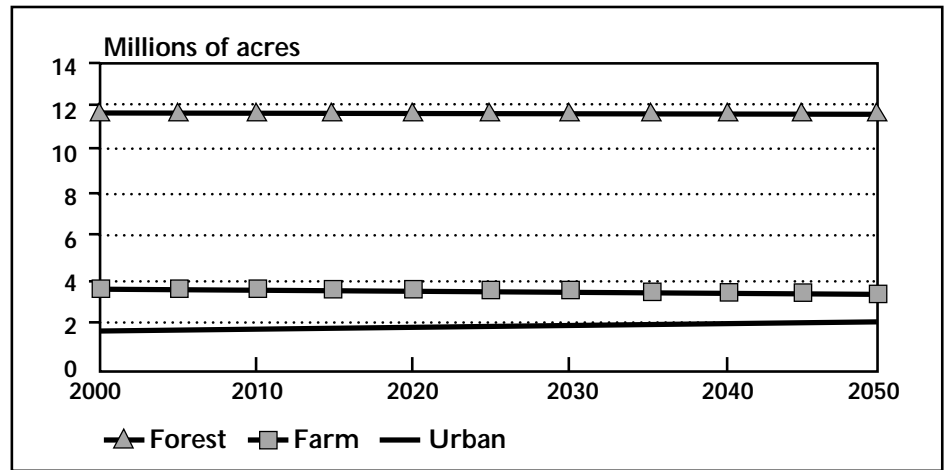
The CLAMS project incorporates urbanization potential with other socioeconomic factors, as well as geographic and physical land characteristics.

"The goal of the land use component of CLAMS is to provide greater clarity regarding the pace and location of future land use change to provide the socioeconomic context in which future forest policies will function," Kline explains. "Urbanization potentially can cause the forest land base to become more fragmented, adversely affecting both ecological and economic outputs."

Ecological impacts could include both direct loss of habitat and diminished habitat quality. Economic impacts could include less intensive forest management for commercial timber production, thereby, resulting in reduced economic output. One current

theory developed in the Southeastern United States (Wear 1999) suggests that as population increases, the probability of intensive commercial forest management decreases. Thus simple estimates of timberland, that do not take nearby development into account, may substantially overstate the availability of timber.

Projections in the Coast Range indicate that lands farther from cities are less likely to be developed and coincide closely with forest lands, whereas lands closer to cities are moderately to highly likely to be developed and coincide more closely with farm lands such as those in the Willamette Valley, according to Kline.



▲ Projected major land uses on private land in western Oregon and western Washington show little change in forest lands, with most change in urban and farm lands, over the next 50 years.

WHAT VALUE IN CHARTING THE FUTURE?

The land use change models potentially apply applications to several economic and ecological policy issues. As Kline notes, although projections cannot show what will actually happen in the future, they can give policymakers an idea of what future demands on forest lands will look like. It enhances their appreciation of the fact that land use will change, and things will look different.

In Oregon, Kline hopes his modeling output will, in time, contribute to a broader debate about land use issues, although he has not seen the image of Oregon's "success" changing yet. Better data and improved analyses will help define more clearly the promise and limitations of regional or statewide land use planning.

Kline thinks it might be interesting to find out what types of communities people in Oregon really want to live in, given a choice. He's not certain that the choices offered under current land use planning provide an exhaustive list.

"Those condos packed inside the urban growth boundaries near Salem, the new strip developments along arterial routes, the highway between Bend and Redmond. . . . The land use law has not prevented these development patterns from occurring within urban growth boundaries. I wonder, is that what we meant when we set comprehensive land use planning in action?"

Kline believes that land use planning programs such as Oregon's may alter development patterns to some degree but may

not be adequate to protect forest and farm lands in the long run.

In the United States, the effectiveness of land use restrictions is ultimately constrained by our belief in the sanctity of private property rights, he says. Tension will always exist between allowing landowners freedom to make decisions about land and controlling the types of land use that result.

"To a great extent, some conversion of forest and farm lands to urban uses is inevitable and is driven by increases in population. Projections of future land use change can form the basis for effective public policy regarding forest and agricultural outputs." These include market outputs such as timber and farm products,

as well as nonmarket outputs such as outdoor recreation, ecological health, and quality of life factors.

"Perhaps the best we can do is to try to steer along a desired path of change toward the kind of communities in which we would like to live in the future."

*"This was one of my prayers:
for a parcel of land not so very
large, which should have a
garden and a spring or
ever-flowing water near the
house, and a bit of woodland
as well as these."*

Horace 65-8 B.C.

FOR FURTHER READING

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SCIENTIST PROFILES



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States. In addition to land use modeling, his current work includes examining the impact of urbanization and forest fragmentation on the forest management behavior of private landowners.

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