

SUMMARY of the Forest Fragmentation 2000 Conference¹

How forests are being nibbled to death by DUCs, and what to do about it.

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Forests are being parceled and peopled. More and more of America's private working forests are being fragmented into smaller pieces that are less viable economically and ecologically: so concluded most of the more than 50 papers and posters presented at the Fragmentation 2000 Conference. According to Best, Peterson, and several other presenters at the conference, the trend is accelerating faster than population growth because Americans are increasing their per capita use of land for housing and other urbanized uses.

About 3 million acres (a Connecticut-size hunk of forestland) is being split into pieces smaller than 100 acres every two years, according to one estimate that was regarded as conservative by most conference attendees. Nearly as much, around 2.4 million acres of forestland, is also being converted to developed land every two years.

Many of the events driving this unremitting movement toward developed uses and smaller pieces of fragmented forests are **Dynamic Unintended Consequences: DUCs**. They are *Dynamic* (full of life) because they are attached to how Americans live: we keep adding more people who increasingly live in larger houses on bigger lots in or near forests. The results are often *unintended*. We don't set out to split forests into green remnants surrounded by houses, streets, parking lots and malls, and policies that push landowners to sell their working forests for development aren't deliberately adopted for that purpose: but those are the *consequences* of common lifestyle choices and many public policies supporting those choices.

The DUCs contributing to America's forest fragmentation are often overfed by the American dream: big houses on big lots in a country setting, good roads and good schools achieved with low tax rates. It's understandable that most people want these things; so opposing these desires is unlikely to succeed. But Americans want forests and the benefits of forests too. Where there are wants, there are ways.

Some conference-generated ideas on identifying and dealing with forest-fragmenting DUCs are condensed below.

WHAT IS FOREST FRAGMENTATION?

Some forest fragmentation from natural disturbances, such as storms, fires and aging, has always occurred and is even necessary for functioning forests. Some human-caused fragmentation is also unavoidable and necessary as populations change, but some is an unintended by-product of choices and policies that accidentally stack the deck against keeping land in forest uses.

Three elements below are familiar repetitive human-caused occurrences, commonly called fragmentation.

1. Fragmenting *ownership* of a large forest tract into several smaller ownerships (also called parcelization);
2. Fragmenting the *vegetation* of a large expanse of forest into isolated pieces by inserting new uses and different mixtures of plants and animals;
3. Fragmenting forest *uses* by converting pieces of land to other uses.

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SOME DUCS

1. Fragmentation rates are increasing faster than population growth. Development-supporting economies keep expanding out over the landscape, replacing forest-and-farm-supporting economies.
2. A “bow wave effect” extends far in front of expanding development. It raises land prices, taxes, social and regulatory pressures that discriminate against rural land uses well before a development rush.
3. Subsidized development demands subsidized services, which increases demand for more development... Most residential development costs government more in services than it pays in taxes.
4. Plants and animals thriving on edge-and-disturbance effects expand; those needing large undisturbed expanses decline.
5. Exotics and invasive weeds replace native systems. Vulnerability to insects and diseases increases. Plantings at developed sites create 67% of the invasive exotics in the U.S. according to Alavalapati.
6. Timber harvests “go terminal” in and near developed areas. One last cut is made in preparation for development; then the infrastructures and economic incentives helping keep land in forests disappear. Since this is not accompanied by a reduction in U.S. demand for forest products, imports rise, driving up harvests outside the area while local forests are unused.

WHAT’S FEEDING THE DUCS?

There are more people with more money, buying more space, and their choices are supported by transportation and communication technology and public policies. The U.S. population is growing and so are incomes and tastes for larger houses and lots. This drives development faster than simple population growth and pushes it out into rural forests and farmlands where the unit price of construction and land is lower. Huge public investments in improved transportation systems reaching into the countryside, combined with communication technology advances have reduced the need to cluster people and businesses in concentrated urban centers and encouraged peripheral locations for businesses and households. So prosperity and freedom of choice drive some of the sprawl and fragmenting of forests, but strong public policies and market approaches encouraging development push the trends further and faster and often block solutions.

Some examples:

1. *Investing in development is highly rewarded by most government policies; investing in forests is not.* Homeowners can easily deduct mortgage costs from their personal incomes and their mortgages are also consistently, universally and strongly subsidized. Forest owners cannot deduct most costs of owning their forests unless they can convince the IRS that they are a for-profit business. Forest subsidies and tax incentives are occasional, limited, unreliable and available to only a few. *Residential developments get more public services than they pay for while farms and forests get less.* On average, farm and forest owners get only \$0.34 worth of local public services for every dollar paid in taxes. Owners of residential properties get \$1.15 worth of services for every dollar they pay in taxes (Peterson). *It’s time-consuming but profitable to develop land under the regulatory system of most urban areas, but profiting by keeping land in forests is unlikely.*
2. *Death and taxes: people who inherit valuable land are forced to subdivide it to pay taxes.* People who are 65 and older hold 48% of all private timberland acres, meaning that land keeps getting divided among heirs. Owners of high-value land who haven’t made complex legal tax-avoidance arrangements before dying leave their heirs with the problem of being forced into selling land and timber to pay high estate taxes.

According to Greene and others, the number and percent of estates owing federal estate tax has risen in recent years. At the same time, increased stumpage prices and urban expansion have driven up the value of both the timber and land components of forestland, pushing more land into higher brackets. Greene estimates that there are presently about 87,000 forest estate transfers annually. Ownerships forced to sell

timber or land to pay the federal estate tax range from under 100 acres to several thousand acres of forestland, and average over 500 acres.

Table 1: Estimate of private forestland estate turnover (From Greene)			
	Acres/ year	Acres in ten years	Relationship to total
All forest estate transfers	59,000,000	590,000,000	150% of the total owned
Timber sold to pay estate taxes	2,600,000	26,000,000	7% of the total owned
Land sold to pay estate taxes	1,400,000	14,000,000	4% of the total owned
Acres developed after estate sale	350,000	3,500,000	1% of the total owned

3. *Environmental services from forests are “Priceless”*-- In reality, forests produce very valuable environmental services, but owners are generally not rewarded for them.

PRICING PRICELESS FOREST OUTPUTS

Markets for timber products are presently the sole monetary incentives for keeping land in forests in most cases. Owners generally receive no payment for the other outputs coming from their forests and so have little incentive to consider them when there is an opportunity to cash in development values. Examples of valuable, but uncompensated, forest outputs are: carbon sequestration, storm water control, clean water protection, wildlife habitat, air quality improvement and a host of other benefits that go to the general public free. These have value as evidenced by the high costs of replacing them with taxpayer-financed engineered systems.

A market-oriented approach, wherein private forest landowners are paid for the services their forests produce is suggested.

Clean water: Forests in New York’s Catskill Mountains provide clean water benefits to New York City equivalent to an initial investment of \$6-8 billion, followed by annual operating costs of \$1-2 billion for an engineered system to carry out the same service. Only recently have there been any limited payments offered to owners of these forests to encourage keeping their land undeveloped. (Alavalapati)

Handling storm water: Water retention services lost from developed forests are generally replaced (poorly) by costly-engineered systems. Peterson (EPA) recently estimated that extensive development in the Baltimore-Washington Chesapeake Bay watershed area had reduced average tree cover to 38% by 1997 (down from 51% in 1973). He estimates that the tree losses increased storm-water control costs for the area by \$1.08 billion.

Carbon storage: Modern society emits massive amounts of excess carbon into the air creating concerns for global warming and a variety of other dilemmas. Forests take carbon from the air and store it. An ecological economic analysis of southern pine timber production by Alavalapati suggests that paying forest owners for carbon sequestered by their forests (to combat carbon dioxide buildup in our atmosphere) would improve the economics of keeping land in forests. The study found that if carbon and other amenity values of forests were *not* considered as market goods, the forestland value per acre was \$366.03 and the carbon storage was 1,914 tons. Paying a conservative value of \$10 per ton of carbon stored and \$10 per acre per year towards other public amenity values increased the land value (as forests) from \$366.03 to \$628.55 and the carbon storage to 2,054 tons. This makes keeping the land in forest uses more financially attractive and reduces the pressure to fragment forests. (Alavalapati)

The price of taxing inherited land at high rates

In 1998, the town of Walpole, Massachusetts (a bedroom community between Boston and Providence) borrowed \$7.7 million to purchase 293 acres of private forests and fields to keep houses from being built there (Davison). *The town’s finance director, David Davison, calculated that if there were 1.18 children in each of the*

163 homes proposed for the land by a developer the Town's additional costs for servicing the development would exceed the costs of borrowing the money to buy the land. The need for Walpole to spend this kind of money was precipitated by the death of the owner of the Adams Farm. The family had kept the land in undeveloped uses for many years, but faced with an estate tax bill of several million dollars (based on development values) they put the land on the development market.

Federal and state budgets gained through estate taxes from this forced sale, but since Walpole was pushed into borrowing \$7.7 million to buy the land, it's doubtful that anyone really gained from this. Each acre that the owner had kept in undeveloped uses prior to the estate sale was apparently saving the town at least \$26,000 worth of service costs. This is a clear case of public policy designed to collect the maximum in taxes pushing development and ultimately costing everyone money.

FRAGMENTATION RATES ARE INCREASING FASTER THAN POPULATION GROWTH

From 1945 up to 1992 each new person added to the U.S. population caused the conversion of about half an acre of undeveloped land to urban uses. The rate more than doubled between 1992 and 1997 as each new person added to the population converted 1.2 acres of undeveloped land to urban uses. About 40% of the land used is forested, meaning that each new person converted .22 acres of forest prior to 1992 and converts about .50 acres now.

Table 2: Acres of forest developed by each additional person have more than doubled

Year	Acres of forest developed for each added person	Acres of forest developed by adding 2,400,000 people per year	Acres used in 10 years
1990	.22	528,000	5,280,000
2000	.50	1,200,000	12,000,000

Sources: Statistical Abstracts of the U.S. 1945-1998; USDA NRCS, National Resource Inventory 1997.

Figures are based on the projected addition of about 2.4 million people per year after 2000. The U.S. added about 2.6 million people per year from 1945 to 1992, while annually converting about 1.4 million acres of farm and forestland to urban uses. From 1992 to 1997, we continued adding about 2.6 million people per year, but annually converted 3.2 million acres to urban uses. Some of the increase in urbanizing rate is due to fewer people living in each house; some is due to tastes and budgets for larger houses and lots and some is from public policies that finance sprawling out. Similar findings are reported on local scales. For example:

- In a recent 20- year period, in the seven Milwaukee metropolitan area counties, residential growth was only 3 % but the land used by the new residences increased by 38%.
- Between 1960 and 1990, the South's share of the U.S. population increased by about 3%, but the amount of southern land covered by metropolitan areas more than doubled, increasing from about 10% to more than 23% (US Department of Commerce 1992).

NATIONAL AND REGIONAL STATISTICS

Table 3: Some relevant national and regional statistics for the U.S.

	North	South	West	US
People per square mile	317	107	33	75
Percent of U.S. population	42%	34%	24%	100%
Population increase, last 20 years	7%	29%	38%	20%
Percent of private timberlands* in U.S.	35%	50%	15%	100%
Percent of all timberlands in U.S.	32%	40%	28%	100%

* Timberlands are forests that are legally and biologically capable of growing sustainable crops of wood.

Sources: USDC, Census; USFS RPA.

Summary of U.S. regions

The North is the most densely populated region and it is also heavily forested. Most of the forests are privately owned and most could be managed as timberland legally and biologically. Population growth is the slowest in the nation, but forests are continuing to be fragmented. A lake states study (MI, MN, WI) found that private forests in the lake-and-forest-north-woods part of the region were almost as parcelized as those in the southern-metro areas: 71% of the private north-woods forest area was in parcels of 40 acres or less compared to 72% in the southern-metro areas. Forests are being acquired as amenities. Nearness to roads and water are significant drivers. (Gobster)

Conversion of natural forest types to exotics and simplified mixes of plants and animals are significant problems in urbanized areas. In Trythall Woods, near Philadelphia, researchers found that the forest had become species-poor. Excessive uncontrolled deer populations had changed plant mixtures to the few they wouldn't eat. This also reduced the breeding bird density. (Heckscher)

The South is the next most densely populated region and very heavily forested. It contains 50% of the nation's private timberland. The population is growing rapidly, creating massive expansions of urban areas. Between 1960 and 1990, the South's share of the U.S. population increased by about 3%, but the amount of southern land covered by metropolitan areas more than doubled, increasing from about 10% to more than 23%. Florida is gaining population at the rate of nearly 900 people per day, decreasing timberland from 19.7 million acres in 1936 to 14.7 million acres in 1995. This is expected to increase, creating significant negative impacts on the environment and the economy. Georgia has the most timberland of any state in the country but also now ranks third in the annual rate of development (USDA FS 1999. US Department of Commerce, 1992). American forest industries have been concentrating in the south in recent decades because of the region's highly productive private forests, but many of those same forests are now under fragmentation pressure as urbanization increases.

The West is the most sparsely populated region due to large expanses of public land and uninhabited areas, but the population is highly concentrated on the available private land, and the overall rate of population increase is the fastest in the U.S. (Alig) Only 15% of the *private* timberland is in the West, but a large segment of publicly owned timberland brings this up to 28% of *all* timberland. Additionally there are large areas of public forests not listed as timberland because they are legally set-aside as wilderness areas where no harvests are allowed. This means that much of the land area of the west will not be fragmented or developed and large areas of forests will never be harvested (although they will burn in large fires from time to time). Removing so much land from market decisions is two-edged: it keeps it land out of development, but puts enormous pressure on the remaining available private land, both as a timber resource and as land that can be developed.

The state of Washington offers some examples of the western growth dilemma. Since the 1950's, the state's population has doubled from 2.4 to 5.6 million people. It's projected to double again to 11 million people within the next 50 years. The public owns more than 54% of the forests in Washington. Population growth has occurred where the private forests are-- in the richly forested coastal counties bordering Puget Sound, within commuting distance of the Seattle metropolitan area. This is resulting in rapid forest fragmentation and conversion. Between 1970 and 1992 non-industrial private forests in Washington State shrunk from 4,535,000 acres to 3,076,000 acres-- accounting for 63% of the loss of timberland from all ownerships in the state (Meacham)

All forest owners have decreased harvests except the one losing the most land: the non-industrial sector. It's likely that some of the increased harvest volume is from "terminal harvests": a last cut made before the land goes out of forest uses into development.

Table 4: Washington’s public forests and industrial owners have reduced harvests while The non-industrial private sector has increased harvests (Meacham)				
	State Lands	National Forests	Private non-industrial	Industrial
1970s: Average Annual harvest, Million board feet	739	937	680	2,600
1990s: Average Annual harvest, Million board feet	451	187	1,034	1,758
(Reduction) or <i>increase</i>	(288)	(1,038)	354	(842)

THREE DUC TALES ON TWO COASTS

On the West Coast, big tall trees make nice decorations, but they keep falling on houses. The community of Sunwood Lakes was inserted into private forestland 11 miles from the State Capital in Olympia, Washington in 1968 (Meacham). Between 1968 and 1991, 327 homes were built in an area covered by young Douglas-fir with scattered larger remnant trees left from previous logging. Today the farms and forests that used to lie between Sunwood and the cities of Olympia, Lacey and Tumwater have been replaced by housing developments, golf courses and shopping centers, putting the community at the southern edge of a nearly continuous metropolitan area stretching the length of Puget Sound. The population of this area has increased by more than 20% in the last ten years

Sunwood Lakes is now a private community with covenants and common areas governed by a nine-member board of elected homeowners. There are 437 lots totaling 131 acres, three small lakes covering 22 acres, 3 acres of parks and sports fields, 18 acres of forested and non-forested wetlands and 72 acres of forested green belts. The commonly owned green belts, ranging in size from a few thousand square feet up to 3.5 acres, serve as well head protection areas for 5 community owned wells. Foot trails throughout the green belts provide recreational walking and lake access. A 2.2-mile road loops through the community, 29 primary cul-de-sacs radiate off the loop road and there are 9 secondary cul-de-sacs. About 246 acres is involved overall. *A nearly continuous serpentine canopy of native forest, highly fragmented by roads and home sites covers all this.*

As the area developed the trees aged and grew. With no management to maintain good growing conditions, the tree crowns closed together, growth slowed, and many trees developed poor vigor and unsustainable height to diameter ratios. Pockets of laminated root rot appeared in several green belt areas, resulting in clusters of sick and dying trees near houses and roads.

The trees began to fall in the early 1990s. Annual winter storms brought down more and more trees, blocking roads and damaging homes, and automobiles. Piecemeal, expensive removal of problem trees by people with little expertise was attempted. Earlier forest management suggestions had been rejected due to a general opposition to cutting trees, but now (1994) the obvious problems of the forest and the damage and inconvenience caused by falling trees motivated homeowners to listen to a pitch for a forestry plan from Steven Meacham, a forester who lived in the community.

A consultant was hired to produce a Stewardship Plan, which was accepted by the community in the spring of 1995. Maintaining the natural character of the community and the quality of life homeowners sought remained paramount in making management decisions, but necessary harvesting, thinning and regeneration was also agreed to.

The project started with a set of demonstration activities and a Homeowners Association tour. These included a low density commercial thinning immediately followed by placement of a variety of nest boxes and forage plantings. Trees were cut very low to the ground to minimize visibility of stumps. Harvest activities and timber hauling were limited to normal school and business hours to minimize impacts to the community. Horses were used to yard timber, minimizing ground disturbance and noise.

Following the demonstrations, similar activities continued in other areas until the end of the school year when all harvesting was suspended to reduce risks involving unsupervised children. Activities resumed after school started in September and continued in stages through the spring of 1996. Once some initial sites had been treated most homeowners were very favorable to the operation. Many requested that the consultant also remove large trees on their lots in order to get more daylight to their homes and reduce risk of falling trees.

Wind-throw and related damage from trees seems to have been substantially reduced by the initial operations, even during the wettest winter in recorded history. And the forests are healthier. Most of the community's 72 acres of forested green belts were thinned to reduce the threat from windfall and provide for more vigorous tree growth. The Homeowners Association received \$47,055 in net timber revenues: more than \$650 per acre. Chipping slash near homes and trails, and using the chips for trail surfacing reduced fire hazards. About 380 songbird and Wood Duck nest boxes were placed throughout the forests. Root rot pockets were reforested with resistant species. Western White pine and other native plants were reintroduced. Residents became more involved and informed in regard to the management of their common areas

After Sunwood Lakes' success, two other forested residential communities in the state are considering amending their ordinances in order to address fire hazards, wind-throw and forest health problems. Plans are underway at Sunwood Lakes for a second round of light thinnings as trees expand to fill the space again. Continuity of leadership and commitment to the vision of managing forests will be important for continuing success. Turnover of Board members and Homeowners Association staff has resulted in reinventing objectives. This, along with the local forester's relocation has resulted in recent false starts and resignation of the consultant responsible for this very successful operation. If the project stalls out and trees start to fall again years from now, will there be an institutional memory about what to do and forest expertise to do it?

On the East Coast, New Hampshire forests are breaking up in the bow wave of an urbanizing economy. New Hampshire is a small state, with low taxes and population compared to Massachusetts, its neighbor to the south. But something's going on. From 1970 to 1994, Massachusetts grew 106%: from 726 people per square mile to 771. During that same time, New Hampshire grew 153%: from 83 people per square mile to 127. The big ship of Massachusetts is pushing a bow wave of intensive development into the most accessible counties of New Hampshire.

	1980	2000	2020
Forested acres	4,970,000	4,823,000	4,630,000
Forest acres lost since 1980*		147,000	340,000
Average private parcel size: acres	47	37	27**
Population	921,000	1,248,000	1,800,000
Acres of private forests per resident	5.4	3.9	2.6
* Each additional resident is converting about .39 acres to development			

Source US. Census, USFS inventory data

** 27- acre average parcel size is an estimate based on projecting current trends. Its validity depends on whether present trends continue.

The personal benefits of exporting development to more rural areas are attractive to the participants. People can get more house and land for their money in New Hampshire and commute to higher paying jobs in Massachusetts.

But the economic effects of this on New Hampshire forests and forestry are not attractive. According to Sarah Thorne, a recent New Hampshire Land Base Survey found that the average size of the state's forest parcels is declining and the economics of keeping land as working forests is going down too. Two thirds of New Hampshire forest products company owners indicated that they are very concerned about their current and future

wood supplies. The survey found that smaller parcel sizes, especially below 50 acres, push up operating costs and reduce stumpage prices. In addition a significant quantity of logging operations are “terminal harvests”: the forests are being cut for the last time in preparation for development. Mill owners estimated that about 10% of the acreage generating their overall supply came from terminal harvests, that’s almost three times the estimated terminal harvests in 1983. In the counties most accessible to Massachusetts (Rockingham and Strafford) loggers estimated that terminal harvests accounted for 31% of the acreage they worked on. They reported only 4% terminal harvests in the southwestern counties. The likelihood of a landowner using expert forestry advice was also found to decline with parcel size.

For people who consider owning forests long term as an investment, the top considerations for buying and keeping land in forests that were ranked “very important” were: (1) Land Price; (2) Parcel size/wood volume; (3) Nearby population density/attitudes. All of these things are negatively affected by increased urbanization. Maintaining the profitability of forest ownerships is important if forests are to remain undeveloped. Thorne identified a 50-acre turning point in many of her findings regarding the economics of owning forestland. Most of the people involved with economic use of forests as forests (owners, loggers, truckers, foresters) did significantly better as parcel sizes went up from 50 acres. Profitability was significantly lower below 50 acres.

Maryland stops feeding urban sprawl. The state of Maryland is under intense urbanization from the expansion of suburbs near Washington DC and Baltimore. The Maryland Smart Growth Program, introduced by Governor Glendening and enacted by Maryland's General Assembly in 1997, (Frece) illustrates an attempt to guide state funds away from projects that feed the unintended consequences of fragmentation and sprawl. Priority Funding Areas (PFAs) are the cornerstone of Smart Growth, channeling state spending for growth related projects into existing communities, and to other areas where local governments want State assistance for well-planned future growth.

The State is now prohibited by law from spending money outside PFAs. These are areas which must: 1) have existing or planned water and sewer service; 2) meet average density of 3.5 units per acre; 3) be consistent with county growth projections. Example of approach: *The University of Maryland* was considering expansion, and requesting state funding for a new campus for Hagerstown on a farmland site near I-70. The state encouraged them to look instead at the Baldwin House, an abandoned department store and one-time hotel in downtown Hagerstown donated for the campus for free. The site is already served by utilities, services, transit and parking. Downtown businesses are excited about the investment and looking now for spin-off opportunities, like a theater in the campus that can be used for other shows to attract people back downtown. The farmland remained farmland.

SOME CAUSES AND EFFECTS PROJECTED

Bigger houses, are using more land to shelter fewer people. Since 1950, the average size of a house has almost tripled: going from about 1,000 to almost 3,000 square feet per house. At the same time, the average number of people living in a house has declined, going from 3.3 people per house to about 2.5. It takes 960,000 new houses to shelter 2.4 million additional people per year now; this is 233,000 more houses than the same population growth would have taken in 1950 and each house also uses more land (USDC Census).

Table 6: Movement toward more owners of smaller pieces of forests combined with losses to urbanization, projected to 2050*			
	Now: 2000	2050	Change
Ownerships holding 100 acres and more	630,000	665,000	Almost static
Ownerships holding 1 to 99 acres	9,400,000	17,400,000	8 million more
Total number of ownerships	10,030,000	18,065,000	8.1 million more
Acres in ownerships of 100 acres and more	260,000,000	168,000,000	Down by 92 million acres
Acres in ownerships of 1-99 acres and less	133,200,000	165,300,000	Up by 32.1 million acres
Total private forest acres	393,300,000	333,300,000	Down 60 million acres

* Assumes 60,000,000 acres lost to development, using current rates of population growth and urbanization: 20% coming out of ownerships of 100 acres plus and 80% out of parcels below 100 acres.
Source: Birch 1996.

Continuing increases in population, division of inherited estates into smaller parcels and forced sales due to taxation in some cases keeps adding more owners and splitting forests into smaller pieces. In an average year, forest parcels that are 100 acres and more add about 690 ownerships and lose about 1,600,000 acres, while the units holding 1-99 acres increase by about 143,000 ownerships and 1,600,000 acres. The effect over 50 years is estimated in Table 6.

Bow wave effect: If you're in a small boat when a big ship goes by you will get bounced around; possibly even get swamped by the bow wave. Large urbanizing areas seem to exert bow waves of economic, legal and social pressures that can swamp forestry in the vicinity. A Virginia Department of Forestry study (1994-1997) found that urbanization had a similar effect on forestry. Although Virginia had 15,400,000 acres categorized as forestland, the Department found that only 8,500,000 acres could ever be managed as working forest: staying in forest uses while producing sustainable wood crops. Much of the reduction in fully functional forests was calculated using research by Wear (1995). *That study found that there was zero chance of finding any active forestry near population densities of more than 150 people per square mile: PSM (one person in 4 forest acres).* The chances of finding active forestry improved as population density declined: a 25% chance of forestry at 70 PSM; a 50% chance at 45 PSM and a 75% chance at 20 PSM (one person in 32 forest acres) (Lui)

SOLUTIONS

Get over it; adapt to inevitable changes. There's a considerable amount of inevitable fragmentation from normal rates of buying and selling land, and from simple inheritance. Foresters and others interested in the fate of forests will have to find ways to work with smaller pieces of land if they wish to assist the millions of people with millions of acres, which will be increasingly clustered in parcels smaller than 100 acres as time goes on.

As parcels fall below 50 acres many will become uneconomic with traditional forestry approaches. But the owners of small parcels have money to spend and are willing to spend it on their little pieces of the Earth. Foresters are, for the most part, ignoring a \$648 million annual market for services to maintain trees on small lots. This figure comes a 1997 Gallup survey conducted for the American Nursery and Landscape Association, finding that more than 22 million American households spent \$14.6 billion for professional help with their private landscapes, gardens and trees in 1997. This is 1 million households more and a \$600,000 increase from the previous year, and the growth is predicted to continue upward. Tree care showed the largest increase in this type of household spending, rising 50%, to \$2.4 billion from 1996 to 1997. *Forested homesite owners, representing 27% of this market, would spend \$648 million annually for tree care. This is more than 12 times the recent USDA Forest Service annual budget of \$51 million for forest Stewardship, FIP and Forest Inventory - Analysis. That's real money, and it's spent without an act of Congress.* (DeCoster)

Stop taxing inherited forestland at rates, which force premature timber harvests and drive land into development. (See section on taxes (Greene) and the story of Walpole, MA. (Davison).

Improve long-term profitability of forest ownership by removing tax disadvantages, and adding market incentives for environmental services that are presently un-priced. (See section on Pricing Priceless Outputs).

A Forest Bank approach, developed by the Center for Compatible Economic Development at The Nature Conservancy, (Gilges) takes an interesting market-based approach. The project's goal is to protect non-industrial private forests within landscapes of high biological importance. It is designed to work cooperatively with private landowners, maintain ownership in private hands, and generate timber revenues in a system that achieves ecological goals. Landowners who deposit timber receive: a) a guarantee that their forests will be managed

sustainably; b) an annual dividend based on the value of their deposit; and, c) the right to withdraw the value of their timber in cash. Permanent rights to manage the timber remain with The Forest Bank. Efforts to date have concentrated on two pilot sites in southwestern Virginia and southern Indiana. The Virginia site to date has accepted preliminary deposits of over 650 acres of forest with a value of around \$750,000.

Build strong coalitions with broad constituencies concerned with forests to support intensive research on public policies that drive forest fragmentation. Organize the coalitions to use solid information to push for solutions at the appropriate government levels. Many tax and regulatory programs appear to increase fragmentation rates, for example. The way public funds are spent can also drive fragmentation by subsidizing development. See section on Maryland's Smart Growth for an example of a working response.

The core for a coalition may already exist in the *National Coalition on Sustaining America's Nonfederal Forests*, a group of diverse organizations with a stake and interest in the nation's forestlands. Patrick Reid, Chairman of the Coalition, discussed the organization in remarks summarizing the Fragmentation Conference (Reid).

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