

**Title:** Changes in Fragmentation of Western Washington Forestland

**Location:** Western Washington

**Duration:** Year 1 of 1-year project      **Funding Source:** Base

**Project Leader:** Andrew Gray, PNW Research station, 541-750-7252,  
[agray01@fs.fed.us](mailto:agray01@fs.fed.us)

**Cooperators:** Gary Lettman, Oregon State Department of Forestry  
Bruce Lippke, University of Washington College of Forestry  
Jamie Barbour, PNW Research Station

**FHP Sponsor/Contact:** Beth Willhite, FHP Region 6

**Project Objectives:** Evaluate the extent and spatial pattern of forest fragmentation in western Washington and its implications for timber management, wildlife and fire fighting.

**Justification:**

a. Linkage to DM Surveys and FIA P2 and P3 plot data: FIA monitoring in Washington has detected very rapid conversion of forest land to nonforest land uses in Washington in the last decade, with 5% of private timberland (270,000 acres) being converted between 1990-2000, and a similar rate of loss in the previous decade (Gray et al. 2005). However, we have little information on the spatial pattern and extent of fragmentation on these lands. Forest area and fragmentation is one of the six leading indicators of US forest health adopted in the FHM Focus Group Resolutions, July 2007.

b. Significance in terms of the geographic scale: The FIA plot sample does indicate, however, that this conversion is not simply limited to the Seattle area. Development has also been occurring along the entire I-5 corridor, on the Olympic Peninsula, and in southwest Washington near Portland. Indeed, Oregon's land-use laws may be exacerbating the rate of conversion in nearby Washington.

c. Biological impact and/or political importance of the issue related to fire: Land conversion and fragmentation is an important political issue in Washington state. The legislature prioritized the acquisition of valuable timberlands in danger of conversion, and researchers at the University of Washington (with which we are collaborating) will be developing strategies for identifying and retaining those forest lands. Fragmentation is an important attribute of forest area that the Forest Service reports on for the international Montreal criteria and indicators (Riitters et al. 2004). With increased fragmentation, the amount of forest-nonforest edge increases and forest patches become smaller. Edges are associated with increased drying of forest fuels, and the spread of weedy species (both plants and animals). As forest patches become smaller

and distances between them increase, the number of native species that can survive in them declines. Homes are often associated with forest fragmentation in Washington, which increases the cost of fighting wildfire as well as the economic damage done by them.

d. Feasibility or probability that the project will be completed within 3 years: Methods have been developed and shown to work in other studies (Lettman et al. 2002). This project is primarily a combination of those applications in a new area experiencing rapid conversion and to answer new questions about the nature of forest fragmentation. Trained and experienced personnel are available, the imagery is free, and computers and other necessary facilities are being donated by cooperators.

## **Description**

### **a. Background:**

Some aspects of fragmentation focused on tree cover are readily assessed with satellite imagery (Riitters et al. 2004). Other aspects concerning change over time and contrasting land use is more difficult. A recently-completed project with the University of Washington using 3 dates of satellite imagery and our inventory data to assess land conversion found that reliably differentiating wildland forest from treed suburban areas, and clearcuts from shrubland, pasture or new housing developments was difficult. A manual process using higher-resolution imagery (aerial photography) has been shown to be quite effective at categorizing land use patterns in Oregon (Lettman et al. 2002).

### **b. Methods:**

Digital aerial photography at a 2 m resolution is available for free to USDA through the Natural Resources Conservation Service website (<http://datagateway.nrcs.usda.gov/>). The procedure delineates polygons on every image into landuse zones, based on the abundance of forest and non-forest land uses and the number of structures (e.g., houses, barns, buildings). In addition, a count of the number of structures in each polygon is conducted. From this, maps of contiguous forest lands are developed, from which patch size and edge can be calculated. Imagery will be selected to coincide with the timing of the satellite data used by our collaborators in the UW study (Bradley et al. 2007), which will allow comparison of technique and refinement of satellite cover classes, and comparisons about the nature of fragmentation and its speed in different areas of the study area. Edge length per square mile and patch size distribution will be calculated for each area and timestep, and maps generated of change in structure density, land use, and fragmentation indices over time. Structure counts will also be overlain on state GIS coverages of harvest permits to see if housing density has an effect on probability of timber harvest.

### **c. Products:**

Report, presentations, and posters will be produced assessing change in fragmentation patterns and their locations, the dispersion of built structures in the forest environment and its implications for timber and fire management, and the implications of forest patch sizes on wildlife species. The fragmentation GIS database will provide a baseline for future studies of deforestation and fragmentation in western Washington.

**d. Schedule of Activities:**

Nov-Dec 2007: Select counties, acquire imagery, set up databases and processing

Jan-Aug 2008: Analyze imagery, compile maps, compute fragmentation metrics

Sep-Oct 2008: Produce final maps and reports for selected counties.

**e. Progress/Accomplishments:**

New project.

**Costs:**

FY08 Budget	Item	Requested FHM EM Funding	Other-Source Funding	Source
<b>Administration</b>	Salary	18,400	20,000	PNW
	Overhead*	600	0	
	Travel	1,000	0	
<b>Procurements</b>	Contracting	0	0	
	Equipment	0	0	
	Supplies	0	0	
<b>Total</b>		20,000	20,000	

Budget narrative: Salary consists of 48 weeks for a GS-7 employee. Overhead is 3% if funds are from outside research, 0% if funds are from research. Travel is to attend annual FHM meeting. Project leader and cooperators salaries and expenses are contributed by their respective units and not shown.

**References**

Bradley, G.; Erickson, A.; Robbins, A.; Smith, G.; Malone, L.; Rogers, L.; Connor, M. 2007. Forest Land Conversion in Washington State. Pp 238-302 *In The Future of Washington's Forests and Forestry Industries, Final Report*. University of Washington College of Forest Resources.

[http://www.ruraltech.org/projects/fwaf/final\\_report/index.asp](http://www.ruraltech.org/projects/fwaf/final_report/index.asp)

Gray, A.N., Veneklas, C.F., and Rhoads, R.D. 2005. Timber Resource Statistics for Nonnational Forest Land in Western Washington, 2001. Pacific Northwest Research Station, U.S. Department of Agriculture, Forest Service Resource Bulletin PNW-RB-246.

Lettman, G.J., Azuma, D.L., Birch, K.R., Herstrom, A.A., and Kline, J.D. 2002. Forest Farms and People: Land use change on non-federal in western Oregon 1973-2000. Oregon Department of Forestry

[http://www.oregon.gov/ODF/STATE\\_FORESTS/FRP/docs/ForestFarmsPeople.pdf](http://www.oregon.gov/ODF/STATE_FORESTS/FRP/docs/ForestFarmsPeople.pdf)

Riitters, K.H., Wickham, J.D., and Coulston, J.W. 2004. A preliminary assessment of Montreal process indicators of forest fragmentation for the United States. *Environmental Monitoring and Assessment* 91: 257-76.