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Comprehensive Waste Management



COMPREHENSIVE WASTE MANAGEMENT



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INTRODUCTION

The Forest Service receives millions of visitors each year to day use areas and campground recreation sites. The high number of visitors means that large quantities of solid waste must be disposed of in a safe and cost effective way. Our “throw-away” society lifestyle has contributed significantly to the tremendous increase of solid waste especially in the packaging of everyday products. According to the 1989 U.S. Congress Office of Technology Assessment document OTA0-424 food packaging is designed to meet multiple purposes including the following:

1. Protection of products during shipping and maintaining a longer shelf-life
2. Prevention of food spoilage
3. Display of consumer information
4. Compliance with government regulations
5. Tamper prevention
6. Theft prevention
7. Consumer convenience
8. Attractive packaging presentation

Many of these products find their way to national forest lands and into a solid waste management program.

Environmental Protection Agency (EPA) statistics show an average person can generate up to four pounds of waste per day. This amount may vary depending on a person’s activity, but the fact still remains that in an average week, a family of four generates approximately 12 pounds of garbage each day.

EPA estimates in 1990 the quantity of municipal solid waste primarily from households, not including industrial sources, was 195 million tons. Eighty-three percent was disposed of in landfills or incinerators and the remaining 17 percent was recycled or composted. Paper and paperboard products make up almost 40 percent of the total weight of municipal solid waste; food waste accounts for less than 10 percent. The remaining percentage is a mixture of yard trimmings, wood, glass, metal, plastic, leather, cloth, and miscellaneous materials. In a not compacted state, solid waste of this type weighs approximately 200 pounds per cubic yard.



Figure 1. Landfill sites have a finite life before they are closed forever.

Today, solid waste management options available to the Forest Service include landfills, incineration, recycling and composting depending on the geographic location of the forests and the level of services in the local communities.

Landfills, because of their low cost, have been the option of choice in past years. Today however, increased costs, closures of nearby landfills, increased pressures to recycle by federal mandates coupled with opportunities to partner with local communities have forced everyone to find alternative methods of disposing of waste.

A common scenario in the Forest Service today is to collect the refuse generated by the public at recreation sites and either transports the refuse from small 32-gallon containers to dumpsters or directly landfills without ever knowing what was in the refuse mix.

PURPOSE

The purpose of this study is to provide Forest Service recreation managers information regarding the contents of the solid waste stream at forest recreation sites. This report discusses the refuse mix, defines the current methods of collection and disposal, verifies the equipment used, identifies alternatives that make waste management more efficient and cost effective at recreation sites. Understanding these elements will help recreation managers decide which waste management practices to consider in the future.

BACKGROUND

This report identifies current methods of refuse collection on Forest Service recreation sites nationwide. The data collected in this report was generated from direct field information in the form of a questionnaire to determine the current collection methods and types of equipment used, followed by a detailed solid waste stream study. A sample questionnaire is included as appendix A. The data collected in the field was analyzed to determine the percentages of different materials (i.e. paper, plastic, metal, glass, etc.) contained in the refuse found at forest recreation sites. Methods of refuse collection and collection equipment was also reviewed at the same sites the waste stream studies were done to determine what the most effective way to collect refuse is. Once the refuse is collected it must be disposed of either in a landfill or recovered in some other manner like composting and recycling. The methods of collection and the different types of containers are usually indicative of the type of disposal being done at a recreation site. Other important elements of refuse collection include the volume of refuse generated and user characteristics.



Figure 2. Typical mix of refuse includes food scraps, plastics, paper, metals, glass, etc.

The volume of refuse generated at recreation sites may determine the size, number, and location of containers. User characteristics can be determined from the types of refuse left at recreation sites. Different user groups generate different refuse mixes and may necessitate changing the types of refuse and recycling containers from one site to the next. For example: a recreation site that has diapers, baby food containers, boxed juices, cereal and milk cartons means that young families are using this particular site.

Waste Management Terms

Confusion over differences between refuse, trash, rubbish leads to uncertainty as to how best to handle solid waste. Knowing the differences between different types of solid waste can help to understand how to best manage the solid waste stream. Most refuse found in recreation sites is a mixture of garbage and rubbish and in some cases, hazardous materials (see figure 3). A list of commonly used terms associated with solid waste management is included as appendix B.



Figure 3. Typical mix of refuse including cardboard, paper, plastics, metals, glass and food scraps.

WASTE STREAM REVIEW PROCESS

Site Selection

Sites were selected in Regions 1, 3, 4 5, 6, 8, and 9 that provided unique recreation opportunities at locations nationwide and assured a good cross-section of the waste stream entering the National Forests. Diversity of elevation, climatological conditions,

accessibility to sites, and proximity to urban communities were considered. Peak recreation use times, were also a factor considered in data collection and particular attention was paid to heavy weekend use and refuse collection days.

The following types of sites were selected for the review process:

- Campgrounds with primarily recreational vehicle use adjacent to a lake or river water at varied elevations and in various forests.
- Campgrounds with primarily recreational vehicle use not adjacent to a lake or river water at varied elevations and in various forests.
- Recreation sites adjacent highly traveled corridors like interstate highways and state highways.
- Recreation sites along low traveled roads in more remote locations.
- Campgrounds used mostly by families staying in tents and campers adjacent to lakes and rivers at varied elevations and in various forests.
- Campgrounds used by families staying in tents and campers not adjacent to a recreational body of water at varied elevations and in various forests.
- Sites included local area visitors and sites with visitors from all over the world.
- Sites near urban centers that have facilities for composting and recycling and mostly mechanical refuse management collection.
- Remote sites that require small quantities of refuse to be transported long distances and/or deposited at transfer stations.

Waste Stream Analysis

The purpose of a waste stream analysis is to attain information to make informed decisions about the best methods for disposing of the refuse collected on national forest recreation sites.

A waste stream analysis entails collecting data on the composition and quantity of refuse generated at a facility. These elements provide important data for determining how to handle the recoverable materials from the waste stream. The data will also assist in planning for the purchase of the correct equipment for collection, storage and transportation of the materials to disposal sites, including recycling centers.

The best way to determine what garbage cans contain is to empty the container onto a large flat surface and sort and count the contents of the container. This was the method used at selected sites and the contents of the refuse containers were carefully counted and documented. (See figures 4 through 8).



Figure 4. Review of the contents of a 4 cubic yard dumpster at the Six Rivers NF to determine the exact mix of refuse generated by the public. Sources of refuse included local day use sites and campgrounds.



Figure 5. Refuse content review at a Mt. Hood NF campground site.

After the paper, plastic, glass, steel, aluminum, cardboard, food waste and other miscellaneous items are counted, the percentages of each type of material can be calculated. These calculations will help determine what type of action is needed to dispose of the materials found in the waste stream.



Figure 6. Investigating the contents of refuse waste streams can mean guarding oneself from contaminants using a respirator and a protective body suit.



Figure 7. The person counting is well protected from chemical hazards as well as strong odors found in the refuse.



Figure 8. Typical refuse mix of large quantities of paper, cardboard, plastics, composites, metals and glass. These items were found in a variety of containers and carefully counted for this study.

The waste stream data was reduced and shown nationally, by region and by forest. Percentages of paper, plastics, composites, organics, metal, glass and hazardous materials were calculated and these percentages are shown graphically in figure 9. The tabulated data is included as appendix C. The information contained in the appendix can assist managers estimate how many containers and what type transportation may be required to adequately service the refuse collection process.

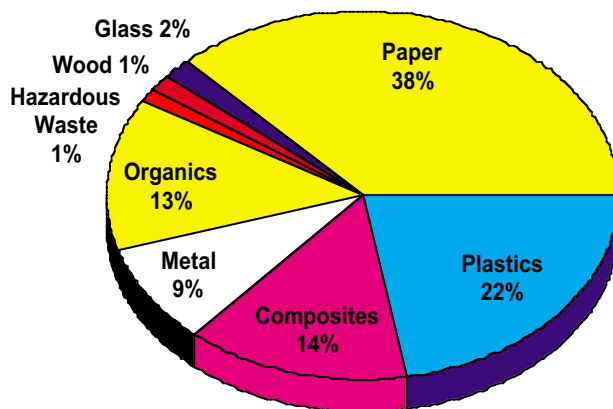


Figure 9. Graphical presentation of data from nationwide waste stream review.

SOLID WASTE COLLECTION METHODS

The recreation sites reviewed for this study used a variety of refuse collection methods. Alternatives ranged from small vehicles (such as pickup trucks) to large roll-off containers that can store and transport tons of material (see figures 10 and 11).



Figure 10. Typical pickups truck and trailer collection system.



Figure 11. Large capacity roll-off container; these units typically haul 25 to 40 cubic yards of refuse. The unit is picked up by a large flatbed truck and pulled onto the truck with a winch.

In the past the most common way to collect garbage from forest recreation facilities was to collect the refuse from 32-gallon containers with no protective liner of any type. This made the task of refuse collection more labor intensive by adding additional time to wash and disinfect the refuse containers.

With the advent of plastic products, including refuse bags, cleaning the inside of 32-gallon container is not as difficult as it was in the past. The time required for regular washing and disinfecting has been cut to a minimum. Currently the refuse picked up by district personnel is almost universally in plastic bag liners; the refuse bags are taken straight to a landfill or to an interim storage location usually in a pickup truck or a stake-side truck.

The plastic trash bag (from grocery store size to 55-gallon size) has become the universally accepted method of storing refuse. The public generally disposes of their accumulated refuse in some type of plastic bag. The refuse inside the bag is placed in a container usually lined with a plastic bag. However, if the refuse is placed directly into a dumpster or a roll-off that is not protected with a plastic liner the container generally requires a more aggressive cleaning schedule to prevent strong odors from developing. These odors are attractants to insects and animals.

The trend seems to be moving to larger and fewer dumpsters. A common method of waste collection today is contracted collection services that serve one or more recreation facilities, using front end, side load, and rear-load dumpster trucks that will transport the refuse to landfill. As concessionaires replace forest employee-managed recreation facilities, methods of doing business have changed as well. In many cases concessionaires still use 32-gallon containers but the refuse is transferred to dumpsters serviced by a refuse contract service company.

IMPROVING SOLID WASTE COLLECTION

Streamlining a collection system begins with good planning and careful assessment of what method can best serve the recreating customer. Streamlining and improving refuse collection can save time and money. In addition, increasing efficiency will minimize waste and maximize resources.

The entire collection system must be assessed, from collection to disposal. Improvements in collection can be achieved by careful monitoring of the refuse content and volume. Keeping track of volume and content can provide the manager with information on who the customers are and what their needs are.

For some sites using small, labor-intensive, hand-collected containers for small volumes of refuse makes sense. For sites that receive heavy use, larger mechanically lifted equipment can be used more effectively. Trash collection at many forest recreation sites have been converting to more centrally located,

larger dumpsters and roll-offs that can hold larger quantities of refuse away from a campground where the visiting public stays.

Location, Access, and Visibility

When siting a refuse collection facility the following items need to be considered: locations of existing refuse containers, access to containers, and visibility.

Refuse container location is a critical element of careful refuse planning. By locating the containers away from campground areas there are less problems with animals drawn by the smell of decomposing food waste. Having the collection area away from campground areas means less disruption of vehicles collecting trash in campgrounds. This practice also reduces the noise of collection vehicles.

When deciding upon a collection location, look for a place that provides easy customer access such as a pull off site or a pull through facility or just an extra widening in the road inside the facility away from traffic. Pedestrian access is critical and universal access must be considered when designing access to refuse collection facilities. Universal access to refuse bins should be carefully assessed when locating or placing refuse containers. Of particular importance is access and egress to the individual containers.

Vehicular access must also be considered when a determination is made as to the type of collection vehicle that will be used for the collection of refuse. Each type of equipment is different and the vehicle dimensions are important when considering the length, width, and overall height of the vehicle while loading, see figures 12, 13 and 14. Low tree branches can affect a front-loading vehicle that loads vertically and may require a high clearance to operate. The turn-around radius of different vehicles also needs to be considered for ease of access and egress of the collection vehicles. For typical pickup trucks and trailers and stake-side trucks access is not as big a problem; small trucks can maneuver more easily and high overhead clearance is not as critical.



Figure 12. Truck and trailer assembly can be used where low tree branches are a common occurrence.



Figure 13. Roll-off trucks require wide turning radius and high tree clearance to drop off and pick up large containers.

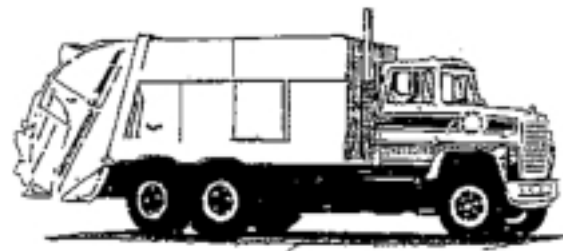


Figure 14. Rear load packer truck requires tree clearance if operated in a heavily wooded area.

Visibility and well placed signing are critical for ease of customer use. Information regarding refuse collection can also be added to a site information handout or it can be placed on information signs at

the entry of all facilities. A strategically placed refuse collection center can be very effective and shrink labor costs by reducing the use of collecting labor intensive small refuse containers.

WASTE CONTAINER EQUIPMENT

Waste container equipment, shown in figures 16 through 24, vary in size and material composition. The containers may be made of a variety of materials such as wood, steel, fiberglass, concrete, plastics, and composite materials. Sizes vary from the standard 32-gallon container to large roll-off containers capable of transporting several tons of waste and recyclable materials. Choosing appropriate containers for a refuse collection program can vary with budget constraints, volume requirements, collection vehicle constraints, and aesthetic considerations. Smaller refuse containers that allow universal access are preferred to larger inaccessible dumpsters.

Dumpsters

Today a growing trend that is a more common method of refuse disposal is the use of dumpsters of sizes from 0.5 cubic yard to 8 cubic yard humpback dumpsters to 24 cubic yard roll-off containers. These large refuse containers are picked up by front-end or back end loader refuse trucks and hauled off site to a landfill. Shorter units, that allow universal access, are the preferred alternative to the tall, less accessible units that require heavy lifting of lids and are too tall for older Americans, children, persons of low stature and persons that are physically challenged. Designing ramps or setting containers in a depressed landing can provide direct universal access to taller containers.



Figure 15. Typical 2 cubic yard rear-load dumpster with



Figure 16. A six cubic yard capacity slope-front-load steel container. This container has been designed for animal proofing and a more user-friendly access door versus the larger dumpsters that must be lifted at much higher levels. Photo courtesy of Capital Industries, Seattle, WA.



Figure 17. Same as figure 21 but in an unloading position with a typical front-end loader garbage truck. Clearances for this type of operation must be planned for in recreation sites. Photo courtesy of Capital Industries, Seattle WA.



Figure 18. An all aluminum front load dumpster, lightweight, minimal maintenance, does not rust, does not require painting. Photo courtesy of Visions Inc.



Figure 19. Typical front-load dumpster that can range in capacity from 2 to 4 cubic yards. This particular dumpster is provided by Waste Management Industries.



Figure 21. These 32-gallon galvanized steel units have been the most used container in the Forest Service.



Figure 20. This campground uses simple 32-gallon containers to collect recyclable material. The refuse is placed in the rear-load dumpsters at this Forest Service campground in Wisconsin.

Small Refuse Containers

Small individual and multiple containers typically 32- to 100-gallons in size are available in steel and plastic models. Animal resistant models are available for sites with large and small animal problems. Shapes may include round and square models with or without wheels. Many units can be secured on a stand, bolted on a concrete foundation or can be ground secured for animal resistance.



Figure 22. This steel refuse container is often called a four-in-one system. Four 32-gallon individual trash bags are placed inside the container. The refuse is deposited in each of the four hinged access doors and is emptied from the front.



Figure 23. Double 32-gallon bear-proof container with an option for recycling. SDTDC prototype. Container anchors to the ground and opens with a swing door for easy servicing of the liner bags. Photo courtesy of Boxmaster.



Figure 24. Accessible triple 32-gallon refuse containers molded with cross-linked polyethylene material. These may be converted to a recycling system. Photo courtesy of Romtec Inc.

Truck and Trailer Hauling Equipment

Pickup trucks and trailers are a necessary part of a small refuse collection program. If only a few bags of refuse and recyclable material are collected at a time, covered and lockable trailers can be used to collect

materials for a longer period of time reducing the frequency of hauling recyclable material to a recycling center.

Other types of trucks, including stake-side, may be equipped for special pickup of either refuse, commingled, or presorted recyclable material. In a large program that may require more storage, a roll-off type container may be practical to handle the volume generated by a large and busy site. Busy sites may also profit from the use of a compactor trailer, which compresses the waste and allows the storage of larger volumes of refuse and/or recyclable materials.

Containers shown in figures 25 and 26 and 27 are the most common types of mechanically operated collection vehicles. These vehicles usually require only one operator.



Figure 25. Front loader system, some units can be adapted for dumpsters and 50 gallon plus containers by using a mechanical arm. Photo courtesy of McNeilus Truck and Manufacturing Co.



Figure 26. Rear loader also commonly called packer may be loaded without overhead lifting. Photo courtesy of Sterling Truck Corporation.



Figure 27. A small collection system may be as simple as a pickup truck and a trailer.

Again, the cost of purchasing, operating, renting, or contracting the equipment needs to be carefully analyzed to determine the most cost effective method of transporting refuse and recyclable material to the local markets.



Figure 28. This roll-off container has several compartments for recycling or for a combined use. Photo courtesy of Capital Industries, Seattle WA.

CONCLUSION

This study revealed a tremendous potential for recovering recyclable, reusable and compostable materials that would reduce the overall volume content that goes to the landfill. By reducing the overall volume of refuse that is disposed of at landfills there is a great opportunity for overall direct cost savings; improvement of customer service; recoverable materials such as aluminum cans and plastic bottles can also generate revenue that has been approved for use in purchasing containers, signs, bags, educational materials, etc. to improve recycling facilities.

Other indirect benefits include; increasing the life of landfills by reducing the overall refuse volume; reducing the overall cost of metal, glass, plastic and paper recovery by reducing the energy requirements to produce new products from recycled material sources; recovery of compostable materials to make reusable products like humus to improve soil health; removal of organic compostable materials also helps to reduce methane levels in landfills.

APPENDIX A

COMPREHENSIVE WASTE MANAGEMENT

SOLID WASTE MANAGEMENT QUESTIONNAIRE

SECTION A: GENERAL

(Please fill in the blank spaces)

Question 1:

May we contact you? Yes ☒ No ☐

What is the number of your Region? 9

Forest name? Nicolet

Ranger District name? Eagle River-Florence

Question 2:

Your Name Bill Reardon

Full Address P.O.Box 1809

Phone Number 715-479-2827

Fax Number 715-479-6407

IBM/e-mail (if available) _____

SECTION B: FOREST TRASH COLLECTION

Question 3:

What is the number of sites at your Forest or District where trash is collected?

What are the types of sites at your Forest or District where trash is collected?

Campground ☒

Visitor Center _____

Picnic Area _____

Dispersed Area _____

Other (please describe) _____

Question 4:

How is trash collected in your Forest or District? Is trash collected by a Forest employee(s)?

Yes _____ No ☒

Other (please describe) _____

If (YES), how many FS employees are required per collection trip? _____

Question 5:

What type of vehicle(s) (i.e., pick-up truck, flatbed truck, etc.) are used for trash collection? Please describe. _____

If trash is collected by a Forest Service garbage truck, is the truck FS owned? _____ Leased? _____

Other? (please describe) _____

Question 6:

What is the total distance of trash collection route over what period of time?

SECTION C: CONTRACTED COLLECTION SERVICES

Question 7:

If you use contract services to collect trash, is the collection done by

A trash collection contractor? X

A trash collection service by a concessionaire? _____

Other?(please describe) _____

Question 8:

What is the name and phone number of the waste collection company that services your Forest or District? United Waste

 800-752-2474

Question 9:

How is contracted trash collection transported?

Pick-up truck _____

Garbage truck X

Other (please describe) _____

Question 10:

What is the total distance of trash collection route over what period of time? 400 miles/week during summer months

Question 11:

What is the cost of collection

Per day? _____

Per week? _____

Per year? \$16,254

Other (please describe) _____

Question 12:

What is the cost of your local tipping fees

Per load? ?

Per ton? _____

Per pound? _____

Other (please describe) _____

C O M P R E H E N S I V E W A S T E M A N A G E M E N T

SECTION D: WHERE AND HOW FAR DOES THE TRASH GO?

Question 13:

What type(s) and how far is the disposal facility used by the forest or contractor?

Public landfill ☒ FS Landfill _____
MRF (materials recovery facility)? _____
Recycling Center? _____
Other (please describe) _____

Question 14:

Select the frequency of trash collected.

Daily _____
Weekly ☒ _____
Yearly _____
Other (please describe) _____ Garbage is collected on a weekly
basis during summer months when campgrounds are open _____

Question 15:

How many pounds of trash are collected

Daily? _____
Weekly? _____?
Yearly? _____

SECTION E: AMERICANS WITH DISSABILITIES ACT (ADA)

Question 16:

Do the containers you currently use comply with (ADA)?

Yes _____ No ☒ _____

SECTION F: CONTAINERS

Question 17:

What size containers does your Forest or District use?

32 gal _____ 55 gal _____
Dumpsters (size, i.e., 1 cy, 4 cy, etc.) _____ 4 yd & 6 yd _____
Other (please describe) _____

What types of dumpsters does your Forest or District use?

Front load dumpsters _____
Rear load dumpsters ☒ _____
Side load dumpsters _____

Question 18:

What type of materials are the containers made of?

Steel X Plastic _____ Concrete _____
 Wood _____ Fiberglass _____
 Other (please describe) _____

Question 19:

Do you have animal (i.e., bears, racoons, porcupines, birds, rodents, bees, etc.) problems on your unit? X If yes, please describe One or two campgrounds have bear problems _____

Question 20:

Are the containers currently being used bear-proof?

Yes _____ No X

Is your Forest or District considering purchasing small animal-proof containers? Yes _____ No X

Is your Forest or District considering purchasing bear-proof containers?

Yes _____ No X

SECTION G: RECYCLING PRACTICES

Question 21:

Are recyclables being collected on your forest recreation sites?

Yes X No _____

Question 22:

What types of materials are being collected and delivered to recycling centers?

Aluminum cans X Glass X Plastic X
 Paper X Other (please describe) tin cans

Question 23:

What size containers are being used? (please describe) 32 gal metal can _____

Question 24:

Total distance of recyclables collection route over what period of time?
 120 miles weekly during busy summer months _____

Are trash and recyclables collected at the same time or at separate times? Separate . Recyclables are collected by F.S. employees, college interns, or volunteers. Not contracted _____

SECTION H: ADDITIONAL IDEAS AND INPUT

Please include any ideas and experiences that would be of benefit to the rest of the Forest Service in the collection, transportation and other solid waste management activities, including field recycling, at your Forest or District. Need stronger message to campers about recycling (a message on fee envelopes?)_____

A better way to prevent private residences from throwing garabage in F.S._____ dumpsters. Many times dumpsters are full of items that are difficult to _____ dispose of such as shingles, insulation, hazardous waste (paints, etc) It is a low priority for F.S. law enforcement to watch dumpsters!_____

(please attach pages as needed)

APPENDIX B

GLOSSARY

The following definitions apply to terms used in this document.

Garbage—Composed primarily of decomposable “wet” food wastes such as left over foods derived from food preparation while at recreation sites. In the mix can be found produce scraps, breads, eggshells, meat scraps, soiled containers, milk product containers and other miscellaneous items. **Garbage** is highly decomposable wet foods that can generate strong offensive odors due to the breakdown of the foods found in the mix, while rubbish does not.

Hazardous waste—The waste material that may pose an immediate health and or environmental health threat due to the quantity, concentration, or physical, chemical, or of an infectious nature.

Refuse—A mix of **garbage** and **rubbish**. Also included in the mix is trash and hazardous materials.

Refuse, trash and hazardous waste—All are found in the forest service waste stream. The public packs supplies, food and other materials to meet their needs while staying in the forest; much of these materials are left behind as one form of solid waste or another.

Rubbish—Composed of dry materials such as paper, plastics, glass, cloth and wood.

Trash—Rubbish containing large bulky items such as beds, furniture and stoves.

APPENDIX C

Waste Stream Data Results								
Recoverable material percentages found in the waste stream								
Location	Paper	Plastics	Composites	Organics	Metals	Glass	Wood	Hazardous
Nationwide	38%	22%	14%	13%	9%	2%	1%	1%
Region 1	31%	21%	13%	13%	17%	2%	1%	2%
CouereD'Alene NF	31%	21%	13%	13%	17%	2%	1%	2%
Region 3	44%	19%	12%	10%	9%	2%	3%	1%
Coconino NF	52%	16%	7%	10%	11%	2%	1%	1%
Prescott NF	41%	18%	16%	10%	8%	1%	4%	2%
Santa Fe NF	37%	28%	8%	13%	9%	2%	2%	1%
Region 4	40%	26%	9%	17%	4%	1%	1%	2%
Fishlake NF	40%	26%	9%	17%	4%	1%	1%	2%
Region 5	31%	28%	16%	16%	6%	2%	0%	1%
Los Padres NF	38%	31%	8%	17%	4%	1%	1%	0%
Six Rivers NF	28%	29%	12%	21%	7%	3%	0%	0%
Region 6	33%	27%	19%	12%	6%	2%	0%	1%
Siuslaw NF	37%	24%	24%	11%	3%	1%	0%	0%
Siskiyou NF	28%	30%	12%	20%	7%	3%	0%	0%
Mt. Hood NF	34%	25%	15%	13%	8%	4%	0%	1%
Region 8	38%	28%	10%	8%	15%	0%	0%	1%
Davy Crockett NF	38%	28%	10%	8%	15%	0%	0%	1%
Region 9	37%	16%	16%	16%	12%	2%	1%	1%
Chequamegon NF	26%	20%	6%	26%	11%	10%	0%	1%
Hiawatha NF	31%	16%	16%	18%	16%	1%	1%	1%
Superior NF	46%	16%	21%	9%	5%	2%	1%	0%