

# Forest Moss

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# Introduction

Collecting nontimber forest products (NTFPs) from private and public lands in Pennsylvania is a time-honored tradition that provides many with income and enjoyment. This publication explores collecting forest mosses from logs, rocks, and the forest floor. Most gathered forest mosses are known as either sheet moss—loose sheets peeled from rocks and logs (Figure 1)—or as mood moss, tight cushions collected from rocks, logs, or the forest floor (Figure 2).

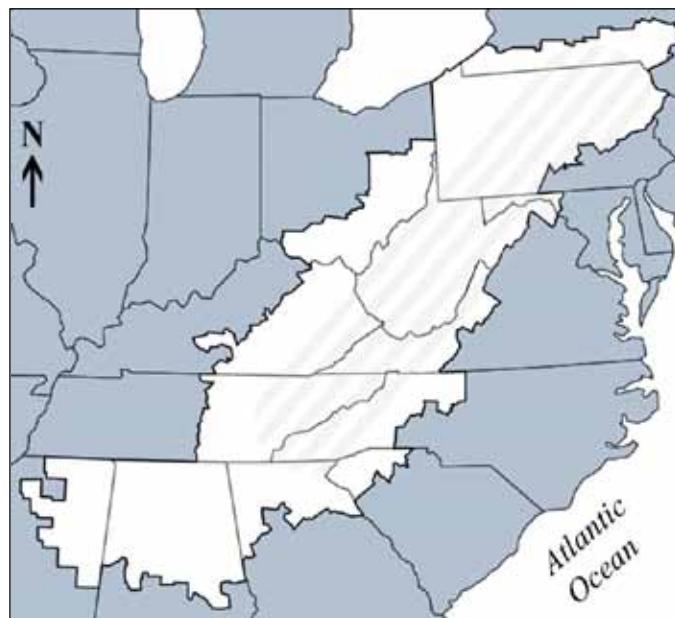


**Fig. 1. Sheet moss is gathered from old logs, such as shown here, or rocks. Source: Jeri Peck**



**Fig. 2. Mood moss is typically found on rocks or on the forest floor. Source: Jeri Peck**

In the eastern United States, the cool, humid conditions favoring abundant moss on logs, rocks, and the ground are most commonly found in the Appalachian Mountains (Figure 3). Permit records and direct observation have confirmed collection in Delaware, Georgia, Kentucky, Maryland, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. The greatest volume of log moss is thought to come from the Appalachians of North Carolina and West Virginia.



**Fig. 3. The Appalachian moss-gathering region extends from southern New York southwest into northern Georgia; the shaded swath represents the area of commercial harvest activity. Source: Jeri Peck**

Sheet moss, log moss, rock moss, haircap moss, and mood moss are gathered from federal, state, and private lands. Permit records in the region indicate that approximately 50,000 pounds (fresh weight) per year were removed from federal public lands between 1997 and 2001, but moss buyers report purchasing upward of 1 million pounds per year. Historically, sheet moss was taken primarily from logs ("log moss" was one of Appalachia's five most wanted plants in 2001), but as rot-resistant logs become more scarce, sheet moss is increasingly gathered from rocks. Mood moss and other cushion mosses can be found on rocks, logs, or the forest floor. Despite the long history of moss gathering in this region, relatively little is known about the impacts of removing moss from the forest ecosystem.

## Uses and Commerce

In the past, moss in this area was used to chink cabins, stuff mattresses, and line both cradles and coffins. Currently, the horticultural trade uses moss as packing material, hanging basket liners, and soil covers for potted plants or terrariums. Moss is also used in arts and crafts (a pinch may provide the finishing touch on an ornament) and in moss gardens and green roofs. Moss is sold in small quantities at garden and craft stores, and a dozen companies sell variable quantities of moss on the Internet.

Sheet moss is usually gathered in contiguous mats by either a quick swipe of one hand ("swipe method") or by placing both hands under a loose mat and lifting, which removes a U-shaped patch. Sheet moss is then either sold fresh ("wet") or air-dried ("dry") after hanging the mats out on a line (facedown to prevent bleaching by the sun) or in an outbuilding. Mood moss is collected as entire, individual clumps (cushions). Most "mossers" collect into 10- or 50-pound feed sacks, which may be available from the local buyer.

Prices vary by product, from year to year, among seasons, and throughout the region, but moss generally brings between \$0.50 and \$1.50 per pound. Moss buyers are mostly locally situated, but buyers and wholesalers from around the country can be found on the Internet. Export records indicate that U.S. moss (thought to be of about 41 percent Appalachian origin, with 59 percent from the Pacific Northwest) is shipped to more than 40 countries worldwide. The economic impact of the moss trade in Appalachia is thought to be at least \$2.3 million annually, but many in the industry believe this is a substantial underestimate.

## Occurrence in Pennsylvania

Log moss is one of the ten most sought-after nontimber forest products in the state. Although suitable forest for growing moss occurs in roughly half of Pennsylvania, it is abundant only where local conditions are highly favorable. Moss is most likely to be found in moist lowland sites near streams and rivers with many logs and rocks. Moss suitable for harvest is not found in dry or exposed sites.

Tree species typical of mossy sites include hemlock, beech, birch, basswood, maple, and walnut. Boulders or rock slabs, tree stumps, and logs must be present to elevate the moss above the smothering leaf litter.

The species of log is also important. Where rot-resistant logs (such as chestnut and hemlock) persist for many decades, several harvest rotations of moss can be collected from the same log. Logs that decompose more rapidly (such as birch) may only be able to support a single rotation (if any) before decaying into the forest floor.

## Biology and Ecology

Sheet moss in the Appalachians refers to any evergreen moss species that forms an extensive interwoven mat. Sheet mosses are typically creeping, relatively flat mosses with a branching pattern that somewhat resembles miniature fern fronds. Moss buyers look for the form and not for specific species. Nonetheless, the vast majority of gathered moss is of a handful of species. Most sheet moss is *Thuidium delicatulum* (commonly called delicate fern moss, Figure 4), *Hypnum imponens* (flat fern moss, Figure 4), or *H. curvifolium* (curvy fern moss), which are among the most common species found in forests throughout the region.

Mood moss can be any one of a dozen species that form compact, rounded, cushionlike clumps. Most mood moss, however, is *Dicranum scoparium* (broom fork moss) or other species of *Dicranum*. White cushion moss is usually *Leucobryum glaucum*. Sometimes, species of *Polytrichum* (hair cap moss) are also gathered.

Because mosses rarely grow in single-species mats, many other species are affected by gathering moss and little is known about the ecology of these species. In addition to a dozen flowering plants that commonly grow intermingled with the moss, more than 70 other mosses



**Fig. 4. The most abundant sheet mosses in this region are commonly known as delicate fern moss (*Thuidium*, left) and flat fern moss (*Hypnum*, right).** Source: Sue Studlar

and liverworts are inadvertently harvested. Liverworts, fungi, lichens, cyanobacteria, and dozens, if not hundreds, of invertebrates are also removed with the moss and salamander habitat is disrupted—one species of salamander has even been found inside collected moss bags. Many landowners regulate moss collection on their lands partly because we know so little about the impacts of moss gathering on these other species.

Moss mats in drier areas tend to have fewer incidentally affected species. As nonvascular plants, however, mosses require external sources of water and are therefore most often found in moist areas. Mosses do not produce seeds or fruits like other plants, but they can reproduce sexually, producing tiny seedlike spores in small pockets ("capsules") on stalks that are green early on and turn yellow, orange, red, or brown as they mature. It is important to leave behind patches with many capsules so these spores can "reseed" the area. Most regrowth following collection, however, comes from regrowth of the fragments (like cuttings) that are left behind. Leaving behind patches of moss, therefore, will also help ensure recovery.

Mosses grow very slowly, between 0.25 to 2.5 inches in length annually. Recovery is slowest (approximately 20 years) when all moss is stripped from the log or rock. Recovery is fastest (approximately 10 years) when a third to a half of a sheet moss is left behind in patches (Figure 5), which then grow over the bare spots. Recovery is not possible when the log decomposes entirely, which is accelerated when mosses are so firmly attached that removing the moss also removes chunks of wood. To ensure recovery and a second or third rotation, mats should only be gathered if they are loose from the log.



**Fig. 5. Regrowth is fastest when large patches (e.g., within the black outlines) are left behind to regrow into the harvested areas, as was found with sheet moss like this in Macon County, North Carolina. Source: Gary Kauffman**

## Gathering Guidelines

Moss gathering has gone on for decades, so why do we need guidelines? Although the stewardship practices of many mossers may not have changed over the years, both our forests and markets for moss have. Logs have become scarcer, increasing pressure on them as both sources of sheet moss and habitat for other plants, bugs, and other animals. This has tempted some mossers to harvest farther into streamside habitats (riparian areas) where mosses play important roles filtering and storing the water and nutrients that forests need to survive and grow. The best way to ensure the health of our forests, however, is to ensure a long-term, sustainable supply of moss, so harvest near streams and rivers should be kept to a minimum.

### What to Gather

Buyers in this region will pay for sheet moss that is shorthaired, clean, green, and hangs together (Figure 6). Shorthaired moss is the creeping kind that lies relatively flat and does not have other plants standing up in the middle (such as ferns or tall, pointy mosses).

Clean moss does not have many leaves or needles on top or much dirt or wood on the bottom. Only moss that is loose from the log or rock should be gathered or it will take too much dirt or wood with it (Figure 7).

For a "moss pelt" to hang together well (for hanging on lines to air-dry), it should be around 1 foot long, at least 0.5 inch thick, and fairly dense. Moss mats on logs are roughly 0.5 inch thick, while those on rocks are generally twice as thick. Buyers will similarly pay for mood moss in relatively large, clean, whole clumps. Each clump should be a colony



**Fig. 6. Good sheet moss has a fresh, green color; flat, even appearance; and forms thin but wide sheets.**  
Source: Jeri Peck



**Fig. 7. Moss so firmly attached that it will not come up without chunks of log should not be taken.**  
Source: Jeri Peck

of a single type of moss, once again lacking other plants or mosses. Clumps should not be covered in leaves or needles, and the backs should not have too much dirt or wood. Clumps should be at least 3 inches across. Not all buyers purchase mood mosses, especially white cushion moss, so check with your buyer before gathering.

Buyers may either reject or pay less for mosses that do not meet these specifications, including dirty moss with too much dirt or wood and sheet moss that is “scrappy” or “fuzzy” and does not hang together. Buyers may also reject moss that is not green or has too many different types of moss mixed together.

### How to Gather

Gather sheet moss by hand with the swipe method, removing only the loose sheets that separate easily from their rock or log (Figure 8). Collectors should leave behind at least half of the moss, preferably in dispersed patches to encourage rapid regrowth. Mood moss must also be gathered by hand to prevent the clumps from breaking apart. Again, collectors should leave at least half of the available clumps (Figure 9). By leaving enough moss behind to “reseed” areas, a second harvest should be possible within a decade.

Do not roll up mosses (like bedrolls) because this tends to take more than half of the moss and results in very slow recovery. Do not harvest moss using rakes or other tools, which may damage the moss and their logs. Avoid cutting other plants, establishing new trails, or damaging the surrounding habitat. Gently agitate the moss (toss it lightly into the air; shaking from an edge may cause sheets to fall apart) to shake out any needles, leaves, or bugs before packing for transport.



**Fig. 8. Harvest loose sheet moss by using the “swipe method” or gently lifting one-foot sections with both hands. Make sure to leave one-third to one-half of the moss behind to regrow. Source: Jeri Peck**

### Where to Gather

Currently, no prohibitions exist against gathering moss from privately owned forestlands in Pennsylvania, if you have permission from the landowner. However, avoid gathering moss from sensitive areas, which include very wet habitats such as bogs, springs, seeps, and any habitat within 50 feet of streams. Also avoid highly decayed logs and exceptionally old trees with decayed bases. Rock outcrops, cliffs, and terraces that support mosses other than the preferred fern mosses are also unsuitable. Collecting moss from these sensitive areas can damage fragile ecosystems, and the mosses gathered will include many incidental species of little to no retail value.

On many public lands, gathering is either prohibited or requires a written permit. In Delaware, New York, and Tennessee, the removal of any plants is prohibited. Some national forests in the region—including but not limited to Monongahela (West Virginia), Nantahala, Pisgah, Sumter (North Carolina), Cherokee (Tennessee), Chattahoochee (Georgia), and Daniel Boone (Kentucky)—and some state forests in Tennessee and West Virginia currently specifically prohibit moss harvest.

In Pennsylvania, moss gathering is not allowed in areas set aside for recreation, protection, or research, such as parks, preserves, research areas, wilderness areas, or natural areas. The Pennsylvania Game commission also prohibits any plant removal on all of their lands. The Allegheny National Forest sells permits for moss harvest on a case-by-case basis; ask for the special forest products specialist at the local ranger’s office. The Department of Conservation and Natural Resources (DCNR) regulates moss gathering according to Title 17, Chapter 21.31 of the Pennsylvania Code, which prohibits “cutting, picking,



**Fig. 9. Mood moss often grows in dense patches on rocks and the forest floor. Remember to leave half the moss behind to regrow. Source: Jeri Peck**

digging, damaging or removing, in whole or in part, a living or dead plant, vine, shrub, tree or flower on state forestland without written authorization of the District Forester or a designee.” However, personal-use gathering of small amounts is generally permitted without a permit on DCNR lands.

Each state forest district develops its own policy covering commercial moss gathering (gathering for sale). It is currently prohibited, for instance, in the Delaware and Tuscarora State Forests. Some districts have adopted the policy of generally prohibiting moss gathering, except in areas scheduled for timber harvest, road construction, or where activities would destroy moss habitat anyway. Regulations concerning moss harvest are subject to change, so contact the local office for any public land-owner on whose land you wish to harvest. Asking for the forester for the Wild Plant Program and mentioning your willingness to coordinate with salvage operations (i.e., harvesting moss before a timber sale) is advisable on districts that generally do not sell moss permits.

When permits are issued, the required information, duration, fees (generally \$5), and harvest regulations all vary by district. Typical regulations include prohibiting harvest using tools and within 100 feet of streams, trails, or roads and/or limiting how much can be gathered. Generally, each individual bag used for transport must display a tag, which must be shown to law enforcement officers and forest rangers at random checkpoints. Some buyers record permit information at the point of sale.

Unfortunately, the reputation of the mossers community is sometimes tarnished by poaching or theft. Moss poaching has occurred in national parks in North Carolina and Tennessee, national rivers and Forests in Georgia, Kentucky, and West Virginia, preserves in Virginia, wilderness areas in North Carolina, and many public and private lands in Pennsylvania. It is very important for the moss industry that gatherers abide by prohibitions where they exist, as moratoria on moss gathering often follow poaching incidents. Those who gather moss without permission face penalties, reduce the potential for future harvests, and give a bad name to all mossers.

## Forest Farming

The precise conditions for maximum moss growth are still not fully understood and few growers have achieved rotations of less than a decade. Moss requires forest cover and cannot be grown in the open. Converting nonmossy forests to mossy forests requires changing the environmental conditions—most commonly by misting to increase humidity, which is generally impractical. Consequently, moss is not cultivated using traditional horticultural systems. However, two companies in the United States promote moss gardening and sell sheet moss, cushion moss, and moss “milkshakes” of blended fragments for propagation (see Moss Acres in northeastern Pennsylvania and Mountain Moss of Pisgah, North Carolina). Woods-cultivated moss is most successfully grown and propagated in patches within forests that are naturally mossy.

It is possible to encourage naturally mossy forests to sustainably produce moss with minimal investment (Figure 10). Besides encouraging the growth of mosses



**Fig. 10. Moss farming is only practical in naturally mossy areas, which can be harvested sustainably for many years by taking no more than half the moss each time and returning only every five years. Source: Jeri Peck**

that are already present, the most important actions for cultivating a patch of mossy forest for repeated future harvests are (1) preserve the logs, (2) harvest in patches, and (3) occasionally clean the moss. Preserving the logs means making sure the moss has something to grow on. Rock moss requires little effort. Log moss, however, requires harvesting only loose moss to prevent removal of the wood substrate. Once the wood is gone, it cannot be replaced and eventually the logs will no longer support moss.

Harvesting in patches (as described above) ensures rapid recovery of bare areas and allows future harvests within a decade. If the patches are small and dispersed, within a few years they will fill in with new moss. The new moss may require ten years before it is loose enough to harvest, but at roughly year five the moss that was left behind during the first rotation can be harvested. If repeated and the log does not deteriorate, this process can continue indefinitely.

Finally, occasional cleaning of the moss helps prevent it from being overgrown by other plants or smothered by leaves. Simply brush away accumulated leaf litter (don't use a rake—it can damage the moss). If you wish to "weed" your moss patch, try not to remove any threatened or endangered plants.

## Concluding Remarks

Forest moss can be sustainably gathered from rocks, logs, and the forest floor if great care is taken to ensure future harvests. Sheet or mood moss can be gathered in clean patches from mossy forests on rotations of five to ten years when less than half of the loose moss is removed each time and multiple patches with many capsules are left behind to reseed through spores or the regrowth of fragments. Moss is most successfully cultivated in the woods by preserving the logs, harvesting in patches, and occasionally cleaning the moss. To protect sensitive populations of plants and animals, moss should be gathered only where it is legally permitted. Care should be taken to minimize the impact of gathering on other plants and animals to preserve the ecological fabric of the forest.

# For Further Information

Information on estimated quantities of moss harvested from the Appalachian region can be found in *An Assessment of Commercial "Moss" Harvesting from Forested Lands in the Pacific Northwestern and Appalachian Regions of the United States: How Much Moss is Harvested and Sold Domestically and Internationally and Which Species are Involved?*, an Oregon State University publication by Patricia Muir (available online at [oregonstate.edu/~mccuneb/Muir2004.pdf](http://oregonstate.edu/~mccuneb/Muir2004.pdf)).

A discussion of moss harvest in West Virginia is available in an article by Susan Moyle Studlar and JeriLynn Peck in the journal *The Bryologist* (available online at [bioone.org/doi/pdf/10.1639/0007-2745%282007%29110%5B752%3ACMHITA%5D2.0.CO%3B2](http://bioone.org/doi/pdf/10.1639/0007-2745%282007%29110%5B752%3ACMHITA%5D2.0.CO%3B2)).

More information on illegal harvest in the Appalachians can be found in "Catching Bandits in the Smokies," a 2001 article in *National Wildlife* magazine by T. Edward Nickens (available online at [www.nwf.org/News-and-Magazines/National-Wildlife/Animals/Archives/2001/Catching-Bandits-in-the-Smokies.aspx](http://www.nwf.org/News-and-Magazines/National-Wildlife/Animals/Archives/2001/Catching-Bandits-in-the-Smokies.aspx)).

To cultivate and grow your own moss, helpful tips can be found in *Moss Gardening: Including Lichens, Liverworts, and Other Miniatures* by George Schenk or the websites of Moss Acres ([www.mossacres.com](http://www.mossacres.com)) or Mountain Moss ([www.mountainmoss.com](http://www.mountainmoss.com)).

To identify these and other mosses in the field, an excellent field guide is Susan Munch's *Outstanding Mosses and Liverworts of Pennsylvania and Nearby States* (Sunbury Press, 2006).

For more information on commercial gathering on DCNR lands, contact the Ecological Services division of the Bureau of Forestry (see [www.dcnr.state.pa.us/info/ataglance/fsforestry.aspx](http://www.dcnr.state.pa.us/info/ataglance/fsforestry.aspx)).

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An OUTREACH program of the College of Agricultural Sciences

Penn State College of Agricultural Sciences research and extension programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

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Produced by Ag Communications and Marketing

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Web code # XH0037