Appendix V. Descriptions of Ecosystem Scale Forest Mycology Experiments

Despite the difficulty of implementing forest mycology experiments at the stand scale, there have been a number of forestry experiments that have included fungal communities as a response. The results need to be interpreted in the context of the characteristics of the ecosystem and plant community of the site, the fungal sampling methodology, and the amount of time the fungal community developed after the experimental treatment was applied. A list and description of each study follows.

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Descriptions of studies

Timber Harvest Experiments

DEMO Study

One major study instigated in response to the original northwest forest plan is the Demonstration of Ecosystem Management Objectives (the DEMO study). This experiment used 13 ha experimental units and had 6 treatments that varied from unlogged (100% retention), through 75% aggregated retention (harvested three - 1 ha patches), to 40%, and 15% green tree retention either dispersed as a continuous thin or aggregated into five or three 1 ha retention blocks (Aubrey et al 2009).

As a part of this study, epigeous and hypogeous fungi sporocarps were sampled from four years before timber harvest to three years after on the iterations of the experiment in the Gifford Pinchot (WA) and Umpqua (OR) National Forests (Luoma et al. 2004). Sporocarp biomass was lower in all harvest treatments, but in the moderate thins (40% dispersed retention) and the larger retention blocks (75% retention), the impacts were reduced. Although sporocarp production is not an ISSSSP fungal program-level management goal, it may be a useful qualitative measure for predicting site persistence and it is informative for food web relationships of the northern spotted owl (*Strix occidentalis).*

A second study looked at ectomycorrhizal root tip morphotypes in soil cores taken in the uncut and 15% dispersed retention treatments (Luoma et al. 2006-citation 76). Within the thinned stands, they also took soil cores within, at, and beyond the drip line of selected trees. They found that there were not significant differences in morphotype richness between control samples and samples taken within the dripline of trees in the thinned stands but richness was reduced in samples taken at or beyond the dripline of leave trees in the thinned units. There also was a reduction in root tip abundance away from the leave trees, suggesting that the lack of tree roots negatively impacted the mycorrhizal network. Taken together these studies suggest that less intensive harvest practices that do not create large gaps in the forest canopy may be able to maintain fungal communities.

Date Creek Silvicultural Systems Study

The Date Creek Silvicultural Systems Study is an experiment from the interior cedar – hemlock (*Thuja plicata - Tsuga heterophylla)* zone near Hazelton, British Columbia that compared the effects of light thinning (30% removed in 1 to 10 tree clusters), heavy thinning (60% removed either in larger, 0.1 to 0.5 ha, openings or small gaps), clear-cutting (12-25 ha units with scattered birch trees left), and an uncut control (Coates et al. 1997).

One study conducted one to four years after timber harvest compared fungal sporocarps and ectomycorrhizal colonization of seedlings planted in the forest, the clear-cut, or different sized gaps (Durrall et al 1999). In that study, sporocarp richness decreased as gap size increased, with a threshold at about 629 to 950 sq. m / 28 – 35 m diameter gaps. Ectomycorrhizal morphotype richness on seedlings decreased dramatically between seedlings planted 8 m and 10 m from a forest edge.

Another study looked at ectomycorrhizal morphotype richness of western hemlock seedlings along transects from within forests and 0, 5, 10, 15, and 20 m from the forest edge into 4 year old openings of the heavy thin treatment (Kranabetter and Wylie 1998). There was a significant reduction in morphotype richness with increasing distance from the forest. Samples in the forest and right at the edge had the greatest richness and there was a large decrease already just 5 m into the gap and another decrease 15 m into the gap.

A third study looked at ectomycorrhizal morphotype richness six years after harvest on birch (*Betula papyrifera*) seedlings collected either within 5 m or 25 to 50 m from a mature birch tree in the clear-cut or within or outside of root contact of a mature birch tree in undisturbed forested patches in the heavily thinned units (Kranabetter 1999). The seedlings planted at a distance from any trees in the clear-cut had the lowest richness while the highest richness was found on seedlings planted near remnant birch trees in either the clear-cut and forested areas, while seedlings in the forest that were not near birch trees had intermediate richness.

A fourth study compared epigeous ectomycorrhizal sporocarp communities five to seven years after harvest in lightly thinned, heavily thinned or uncut stands that varied in the proportion of ectomycorrhizal hemlock and arbuscular mycorrhizal cedar trees (Kranabetter and Kroeger 2001). There was no significant differences in species richness between the thinning treatments or the control. The relationship between the basal area of ectomycorrhizal tree species and species richness differed between the three sampling blocks. In the block with the largest range in basal area values, there was a significant positive relationship between ectomycorrhizal tree basal area and fungal richness. The other blocks had narrower ranges and neither had a significant correlation between richness and basal area, although one block had a distinct trend of richness decreasing with higher basal area. These results suggest that conserving the fungal richness is possible if ectomycorrhizal tree basal area remains above about 30 m^2 per ha and there are enough surviving mature trees to maintain the ectomycorrhizal network across the stand.

A fifth study used one old growth Date Creek stand as a part of a stand age chronosequence in the same area to look at sporocarp communities in 0.3 ha hemlock stands (Kranabetter et al. 2005). This study found that species richness ranged from 37 taxa in pole stands where total basal area averaged about 18 m^2 per ha to 59 taxa in young stands with a basal area of 55 m^2 per ha and around 70 species in mature and old growth stands with a basal area of around 60 m^2 per ha. This study highlights the gradual increase in fungal diversity through time following a clear-cut.

Taken together, these studies point to the importance of conserving enough mature and old trees throughout the stand preserve diverse mycelial inoculum and a relatively continuous supply of tree root tips to maintain the mycorrhizal network and fungal species richness. In this area there was a decrease in ectomycorrhizal colonization on seedlings planted more than 5 to 10 m from a mature host tree, but sporocarp communities did not have significant declines in gaps up to about 28 m across, or in stands with more than about 30 m^2 per ha basal area.

Green Peak Density Management Study

An experiment on BLM land near Corvallis, Oregon compared epigeous ectomycorrhizal sporocarp communities from just prior to timber harvest to five years later in stands that varied in the density of leave trees after harvest from around 420 per acre in the uncut, 56 year old stand to 100, 200, or 300 trees per acre in the low, moderate, or high residual treatments (Norvell and Exeter 2004). Researchers found there were no significant differences between the control and the light or moderate thins, but there were differences between the control and the heavy thin and the clear-cut. This study suggests that thinning less than about 50% of the forest has little effect on the epigeous ectomycorrhizal sporocarp community.

Forest Ecosystem Study

An experiment at Fort Lewis Military Reservation near Olympia, Washington compared truffle biomass in 55 to 65 year old stands that were un-thinned (relative density (RD) = 7.6) or experienced light (RD=6), moderate (RD= 4), or heavy (RD=2) thinning (Colgan et al. 1999). They found about two times the truffle biomass in control rather than thinned plots with more truffles on many sample dates in light than heavy thinned plots. Interestingly, fungal species varied in their response with some species fruiting more in the thinned stands. Since sampling took place soon after harvest, the authors suggest that the fungi with more abundance in the thinned stands may have been induced to fruit, rather than they had larger populations. This study suggests that thinning may be bad for truffle species, but also points out a pitfall of studies that monitor sporocarps soon after the treatment.

STEMS1 experiment

The Silviculture Treatments for Ecosystem Management experiment (STEMS1) is in the Coastal Western Hemlock very dry maritime forest subzone near Campbell River, British Columbia, Canada (de Montigny 2004). 55 to 60 year old forest was subjected to seven different treatments, but fungal sampling focused on interior forest areas in the unharvested and modified patch cut (avoiding the small patch cuts) treatments and retention patches ranging from single trees to a cluster of 80 trees in the aggregated retention treatment. Ten years after timber harvest, roots were sampled from soil cores taken from within the dripline of individual Douglas fir trees, ectomycorrhizal root tips were identified by morphotype, and morphotypes were identified by BLAST matching of ITS genomic sequences (Kranabetter et al. 2013). Additionally, three years of fall epigeous sporocarp surveys were conducted.

There were significant differences in sporocarp richness between retention patches and the uncut forest, but there were not differences in morphotype richness on the root tips. This suggests that the microclimate differences between retention patches and intact forest may lead to a reduction of fungal fruiting, even if most of the species survive as ectomycorrhizae. This could be an issue for species that persist by frequent reestablishment from new spores (which the authors suggest may be the case for a late seral *Russula* species). For conserving most of the species in the area, the authors suggest that, based on species area curves, patches of between 0.13 to 0.25 ha (about 20 – 30 m radius) "should provide an adequate extent of habitat for capturing much of the local, site-level species diversity" (Kranabetter et al. 2013). They also calculated from the sporocarp data that retaining a minimum 3.1% of the area would conserve 95% of the landscape diversity in the area. These estimates are designed to capture most of the diversity and may be too small to preserve the rarest species.

Sicamous Creek Silvicultural Systems Trial

An experiment from the Engelmann spruce – subalpine fir zone on the Cariboo Plateau in the southern Interior of British Columbia tested the effects of the distance from the forest edge in clear-cuts of different sizes (0.1 ha, 1 ha, and 10 ha) on ectomycorrhizal root tip morphotypes from soil cores (Hagerman et al. 1999). They found a progressive reduction in ectomycorrhizal root tip morphotype richness for each of the three years after clear-cutting as tree roots dies and decayed. All of the plots in the cut blocks were significantly different from the forest plots and not different from each other, but there was a clear trend for higher species richness in plots 2 m from an edge than any of the plots 16 or more m from an edge. Beyond the trend for reduced richness with distance from forest edge, there was no difference in richness at a similar distance from the edge in clear-cuts of different sizes. This result implies that smaller cut blocks that minimize the distance from a forested edge would retain a higher diversity of mycorrhizae than larger cut blocks.

Siljansfors Experimental Forest

A study that compared fungal communities in natural (157 to 174 year old) boreal scots pine (*Pinus sylvestris)* forest in central Sweden with 30 to 50 year old stands established after clear-cutting and planting or shelterwood harvest and natural regeneration of 1 ha stands used three different sampling methods, Ectomycorrhizal root tips from soil cores were identified by matching ITS markers among RFLP products in 1995 (about 30 years after harvest), epigeous ectomycorrhizal basidiomycete sporocarp inventories from 1995 to 1998, and BLAST matching of ITS sequences amplified from soil cores in 2013, about 50 years after timber harvest (Varenius et al. 2016). In general, the old forest had the highest richness followed by the shelterwood and then the clear-cut, but the differences were not significant.

Long Term Site Productivity (LTSP) Experiments

Long-term Site Productivity (LTSP) experiments are a standardized factorial experiment that has been implemented in numerous forest regions around the world. There typically are three levels of organic matter removal including harvesting just the tree boles, harvesting the tree boles and removing the slash, or harvesting the boles and removing both the slash and the forest floor. Along with the organic matter removal treatments, there are compaction treatments that include no compaction (as little as possible during the timber harvest), moderate compaction, and severe compaction. The compaction treatments tend to be less standardized and typically include a certain number of passes of whatever machinery is used in the timber harvest. An unharvested stand typically is used as a reference site.

Priest River LTSP

One of the earliest LTSP studies that looked at the effects of these treatments on fungi was from the experiment in the Priest River Experimental Forest in northern Idaho. The stands included western white pine (*Pinus monticola),* western hemlock *(Tsuga heterophylla),* Douglas fir (*Pseudotsuga menzieii),* and western larch (*Larix occidentalis*). The moderate compaction treatment used two passes of a grappler machine and the severe compaction treatment used four passes of a DC6 Caterpillar tractor. There were two studies conducted, both of which planted Douglas fir and western white pine seedlings and looked at the ectomycorrhizal and non-ectomycorrhizal root tips and classified ectomycorrhizae by morphotypes.

In one study, the researchers found that compaction limited the amount of root tips on Douglas fir seedlings planted soon after harvest and harvested a year later, but a higher proportion of the root tips were mycorrhizal (Amaranthus et al. 1996). However, the severe compaction treatment had lower morphotype richness per sample than the less compacted treatments. The effects of the organic matter removal were minor except in the severe compaction treatment where the treatments with more organic matter removed had a lower percentage of ectomycorrhizal root tips than the bole only treatment. There were no significant effects for the pine seedlings. This suggests that soil compaction can reduce the amount of host available for mycorrhizal fungi and limit the diversity of species that can succeed on the site.

A second study from the same area looked at just the bole harvest treatments and only the no compaction treatment, the severe compaction treatment, and an additional treatment of stump removal (Page-Dumroese et al. 1998). For Douglas fir, total root volume was significantly reduced in the compaction treatment when compared with the no compaction and stump removal treatments while stump removal root volume was less than the no compaction treatment, but the difference was not significant. The no compaction treatment had many more root tips than the other treatments and significantly more morphotype richness. Stump removal results were similar to the compaction treatment. There were no significant differences for the white pine seedlings.

Both of these studies found that compaction reduced root growth but increased the proportion of root tips that were mycorrhizal. However, the morphotype richness was most in the no compaction treatment. It was also interesting that western white pine was much more resistant to these treatments than the Douglas fir.

Multiple LTSP Site Summaries

A more recent study looked at fungal communities in soil cores with ITS sequence matching to identify the fungi. The researchers looked at six LTSP experiments in British Columbia, three in the southern boreal spruce zone and three in the interior Douglas fir zone 15 years after harvest (Hartmann et al. 2012). This study presented results for different soil horizons and for all species and higher taxonomic groups. Information on whether the listed or related species occur in the organic or mineral layer and the response to the treatments for many of the listed species presented in Appendix IV. The researchers did not calculate species richness, but they did analyze community composition and found most of the variability between plots was explained by the soil horizon, the forest zone, and the site, but there were also significant differences between all treatment types with a stronger effect of the organic matter removal treatment than the effect of compaction. There was not a difference in soil bulk density between the moderate and severe compaction studies. Overall, ascomycetes increased and basidiomycetes decreased in harvested plots. The species that decreased in the harvested treatments included most of the ectomycorrhizal species. In general, the biggest differences were between the unharvested stands and any of the treatments. When the data was analyzed without the reference stands, there were only a few species that had strong responses to the treatments. This suggests that both timber harvest in general, and the level of compaction and organic matter removal can impact the fungal community.

Another study looked at multiple LTSP studies across North America, but only at the organic matter removal treatments (Wilhelm et al. 2017). This study included the six British Columbia studies along with three studies in ponderosa pine forests in California and several other studies in the east from Ontario to Texas. This study found that ectomycorrhizal fungi tended to decline in the harvest treatments while fungi considered heat or desiccation tolerant tended to increase. This difference tended to result in an increase in richness (of both macro and micro fungi) in the more extreme treatments, but a loss of species from many of the fungal groups that are represented among the listed species.

Swiss Compaction Study

A study from Switzerland looked only at compaction of logged sites, artificially wetting the soil to create more severe compaction (Hartmann et al. 2014). Unlike some other studies, this experiment successfully resulted in a gradient in bulk density with significant differences in all three treatments. At both sites, fungal abundance was about the same in the no and moderate compaction treatments, but significantly lower in the severe compaction treatment. There was also an increase in fungal richness in the more compacted sites. This increase was due to an increase in many Ascomycete species overwhelming a decrease in many Basidiomycete species, including many groups that include listed species such as the Cortinariaceae and Russulaceae.

Deschutes National Forest Compaction and Subsoiling Study

This was an experiment that looked at the effects of compaction and subsoiling after salvage logging in Ponderosa pine – Douglas fir forests that were burned in the B and B fire on the Deschutes National Forest. The researchers compared sites that were visibly impacted by heavy equipment, areas that were compacted and then subsoiled, and un-compacted sites (Jennings et al. 2012). The compaction treatment had no significant effect on soil bulk density, while the subsoiling treatment did reduce the bulk density of the soil at 10 cm deep. However, the soil strength was increased by compaction. There were no differences in fungal richness between treatments. It could be that the volcanic sandy loam soil limited the impacts of the treatments.

Overall, the LTSP studies suggest that soil compaction and increased levels of organic matter removal can impact fungal communities. The inconsistent effects of compaction in these studies could reflect differences in the amount of compaction caused by the machinery and harvest practices that are used in the experiment as well as the susceptibility of the soil to compaction.

Thinning Followed by Prescribed Fire

Swain Mountain Experimental Forest

An experiment from the Swain Mountain Experimental Forest on the Lassen National Forest of Plumas County, California, in *Abies concolor – Abies magnifica* forest sampled hypogeous ectomycorrhizal sporocarps 10 or 17 years after stands were thinned at different intensities, and at one site, thinned units were either broadcast burned or not (Waters et al. 1994). They only identified the truffles to genus, so they did not report species richness. only biomass and frequency. There were no significant differences between treatments for fungi overall, but several genera had significant results, either increased or decreased frequency in treated sites. The results for the genera that include listed species are in Appendix IV.

Teakettle Experimental Forest - Sierra National Forest

An experiment from the Teakettle Experimental Forest in >200 year old sierran mixed conifer forest in the Sierra National Forest of Fresno County, California compared hypogeous ectomycorrhizal sporocarp communities in the first two years after light thinning (40% canopy remaining, no trees >76 cm DBH cut) or heavy thinning / shelterwood (~25 dominant trees per acre), and November burn treatments with 20-40 % ground cover burned in unthinned plots and 35 - 70% in thinned plots (Meyer et al. 2005). There were no differences in species richness between the unthinned / unburned control and the lightly thinned / unburned control. The unthinned / burned treatment had slightly lower richness but the difference was not significant. The heavy thin treatment had significantly lower species richness than the control for both the burned and unburned treatment, as did the lightly thinned / burned treatment.

The researchers also sampled fungal spores from fecal pellets of trapped lodgepole chipmunks (*Neotamias speciosus).* These chipmunk surveys may be able to more effectively locate uncommon sporocarps than fixed area plots raked by a human, but they introduce more uncertainty about the sample area and due to diet preferences (Meyer et al. 2005). There were not significant difference in generic richness of fecal pellet spores between any of the unburned plots and the unthinned / burned treatment, but the light thin / burn treatment was significantly reduced and the heavy thin / burned treatment was reduced even more. The overall fungal frequency in the pellets had a similar pattern, but there was a trend for reduced frequency in the heavy thin / unburned and unthinned / burned treatments, These results suggest that relatively light thins, that maintain the largest trees, can have minimal impact on fungal communities while heavier thinning that significantly opens up the canopy can have negative effects. It also suggests that even relatively mild burns can have negative effects on fungal communities especially after thinning. However, this was a short-term study and sporocarp responses may not reflect changes to the mycelial community over the long term.

Wapiti Ecosystem Restoration Project

This study from the Hungry Bob study area of the Wallowa Valley Ranger District of the Wallowa – Whitman National Forest was a factorial thinning and burning experiment in ponderosa pine – Douglas fir forests. The thin left the largest ponderosa pines and changed basal area from about 25 m^2 per ha to about 16 m^2 per ha. The burn was done in fall, two years later, and was conducted to achieve low flame heights. It was a little more intense in the thin and burn treatment to ensure the slash was consumed (Youngblood et al. 2006).

One study at the Wapiti experiment used RFLP analysis of ectomycorrhizal root tips collected from 10 cm deep soil cores taken from near the dripline of a ponderosa pine both one year before and one year after the treatments were applied (Smith et al. 2005). They found the highest richness in the control stands, slightly lower richness in the thinned stand, significantly lower richness in the thin and burned stands and the lowest richness in the unthinned and burned stand. There were large reductions in richness in the upper 5 cm of the cores and slightly smaller reductions in both burned treatments when compared with the unburned treatments.

A follow up study was conducted 10 years after the treatments and used the same sampling methods. In this study, there were no differences in RFLP richness between treatments (Hart et al, 2018). However, a species accumulation curve model found that the species density was lower in the thin only treatment than any of the other treatments.

These studies are unique in using very similar sampling methods at to different phases of the response to the treatments. They show a thinning and burning project that preserved the large, fire resistant trees and had relatively low intensity fires had a short term negative effect of the treatments on species richness, especially in the burn treatments, but the effect was largely gone after 10 years.

Prescribed Burns

Pringle Falls Broadcast Burn and Simulated Log / Pile Experiment

An experiment that compared the effects of low and high severity burning (conducted in May) in ponderosa pine stands in the Pringle Falls Experimental Forest in the Deschutes National Forest, Oregon, used piles of smaller logs to simulate the fire severity that would be seen if a large log was burned and compared it to a broadcast burn through the typical forest floor.

An initial study at this site looked at soil cores taken either about 1 week before the burn or three weeks after and used ITS sequence matching to identify all fungi in the cores. They found a negative effect on species richness for both burn treatments, with a somewhat larger reduction in the high severity than the low severity burn (Reazin et al. 2016). There was an even stronger effect on community composition with the low severity burn plots and all pretreatment plots clustered together on an nonmetric multidimensional scaling (NMS) ordination (indicating similar communities) and the high severity burn plots distant from the cluster (due to the dominance of a few post-fire ascomycetes).

A second study looked at the ectomycorrhizal communities of ponderosa pines planted 8 days post – burn and sampled 4 months later. This study also included an unburned treatment at each plot. They used ITS sequence matching to identify the ectomycorrhizal root tips (Cowan et al. 2017). There was no difference in mycorrhizal colonization between the unburned and the low severity burn, but the high severity burn was significantly lower than both. There were no differences in species richness between treatments, but species responded differently to the treatments with some species more common or only present in one treatment and other species more common or only present in other treatments.

These studies demonstrate that low severity burns can have minimal effects on the fungal community in ponderosa pine forests, while the effects of high severity burns can be larger. However, in this study, where the burn piles were relatively narrow (less than 2 m wide), a diverse array of mycorrhizae were able to rapidly colonize seedlings.

Crater Lake Burn Season Experiment

An experiment tested the effect of different burn seasons (mid-June, late June, early October, and unburned) on sporocarp production in the Ponderosa pine zone of Crater Lake National Park, Oregon (Trappe et al. 2009 – Citation number 148). Researchers found that the fall burns had the least amount of litter and woody debris along with the lowest Carbon to Nitrogen (C:N) ratio. The highest values were in the control, which were significantly different from fall burns. The spring burns were intermediate with the early spring more like the control and the late spring more like the fall burn, however, there were not significant differences except for fine woody debris. There were clear differences in fungal sporocarp communities in the first three post-fire years as shown by an NMS ordination between fall burn and control sites Early and late June burn site communities were intermediate, late June burn sites were more like October burn sites, while mid-June burn sites more like control sites. This trend suggests that the effect of fire increases as soil moisture declines from early spring to fall. Since the sampling was done so soon after the fires it is likely the response was due to an inhibition of fruiting (perhaps due to damage of the mycelium from the fire) or a stimulation of fruiting by the burn treatments. The differences in soil and organic matter characteristics of sites were driven both by the effects of the fires and by differences in the treatment units, so the authors grouped species into guilds based on whether they were typical of low C:N ratio sites or high C:N ratio cites. Species that were indicators of low C:N sites were typical of the October burned treatments, but they could also have been found in other areas with low C:N ratios.

Emigrant Creek Burn Season Experiment

An experiment from the Emigrant Creek Ranger District of the Malheur National Forest, north of Burns, Oregon, compared October and June prescribed burns in mostly second growth ponderosa pine forest (Smith et al. 2004). Both fires achieved approximately 60 cm flame lengths and caused slight to severe bark or crown scorch on most trees. After four years, about 20% of the basal area was killed in the fall burn and about 6% in the spring burn. Ten cm deep soil cores were taken both the summer before the burns and the first two summers following the burns, root tips were extracted and identified with RFLP matching. Fall under burning in dry ponderosa pine stands significantly reduced duff depth, live root biomass, and ectomycorrhizal RFLP species richness compared with spring under burning, for at least 2 years. Spring under burning response for these variables was generally similar to that on the nonburned treatment.

Sierra National Forest Prescribed Burn Study

A study was conducted in ponderosa pine – incense cedar forest in the Sierra National Forest in California that compared the ectomycorrhizal root tip communities (identified by RFLP matching) from soil cores taken just before and 1 year after a late June prescribed burn both within and outside the burn perimeter (Stendell et al. 1999). The 40 cm deep soil cores were separated into an organic layer, and an upper and a lower mineral layer. There was an eight-fold reduction in the ectomycorrhizal biomass in the organic layer of the burned plots, but there were no significant changes to the ectomycorrhizal biomass in the mineral layers. In the fire plots, 18 RFLP species were present before the burn, but not after, while only three were present after the burn but not before. A few species were dominant in the pre-fire plots due to their abundance in the organic horizon, but were very rare or undetectable after the fire. These results suggest a prescribed fire can impact the fungal communities, especially species that mostly occur in the organic soil layer.

Hitchiti Experimental Forest Long Term Fire Return Interval Experiment

A 19 yearlong experiment testing the effects of different fire return intervals on loblolly pine (*Pinus taeda*) forest in Jones County, Georgia, USA, compared stands burned every 2 winters (9 burns over 18 years), every 3 winters (6 burns), every 3 summers (5 burns because they skipped the last one due to fire danger), every 6 summers (2 burns – they skipped the last one) and control stands only burned along with all the other plots just before the experiment began (Oliver et al. 2015). Three years after the burn treatments ended, soil cores were taken and the fungal community was identified by ITS matching. There were no significant differences in fungal species richness between treatments, but there were clear differences in community composition. There were significant differences between the control plots and the plots burned every two or three years, while the burned every 6 summers plot (which had not been burned for 10 years) was only marginally different from the controls. These differences were attributed to a sorting of the community into fire adapted species in the frequently burned plots and fire sensitive species in the control plots. This experiment demonstrates that frequent fire regimes can shape the fungal community and select for different species than areas with infrequent fires.

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