WOOD

Types

The spruce and maple used in violin making can come from many sources, even different continents. Though there's uncertainty as to the precise geographical origin of the wood used in the greatest Cremonese violins of the 1600s and early 1700s, one certainty is that it was European, and probably from somewhere relatively nearby.

In the spirit of using local woods, I've tried a number of sources for the available New World woods, and sometimes found American softwoods to be tonally unsatisfactory. American maples have worked better for me, though some varieties can be extremely hard and difficult to work. If you are not concerned with having a traditional look, there are some very beautiful and unusual figures available in American maple.

For tops, I've tried Engelman, Eastern red spruce, and Sitka. Engelman is quite variable in its qualities, ranging from a light, spongy wood to something closely resembling, and reputedly often sold as, European spruce. The examples I've seen of both red spruce and Sitka have been more dense and heavy than I'd like my violin wood to be, but I do understand that these woods can be quite variable in quality, depending on the source.

All three woods, though adequate, in my hands lacked the one thing I most want from a top wood: complexity of sound. Engelman was the worst in this respect for me, and I've delegated my stash of that wood to be used for bass bars and blocks, where it functions well. Red spruce was tonally sufficient, but the wood that I was able to find looked lifeless when unfinished, and not much better under varnish. That may be just the particular samples I've used, though. I'm using my red spruce supply for blocks and linings now, too. I have not tried Sitka, but I have some samples of various types that seem especially promising that I bought from Bruce Harvie at Orcas Island Tonewoods. He sent me a range of types he thought I'd be interested in. I've found American dealers to be very accommodating regarding special requests, and Bruce was particularly understanding. Many American makers use American top woods, and so I don't discourage you from trying them. Just be aware that you may eventually want to test the possibilities of all the available types of wood, and the various sources, before settling on one.

In maples, of American woods I've only used hard Michigan maple and another relatively dense Midwestern maple that I can't identify. Hard maple is an extreme example of U.S. maples--it's very dense and heavy, and difficult to carve. When I did make violins with it, I worked to weight rather than thickness, and the resulting violin backs, though thin by European maple standards (mine running from 1.8mm in the thin spots to 3.5mm at the most), sounded fine and held up well. My customers found the wood attractive, and didn't question where it was from. In every respect the wood was satisfactory. I haven't used other new world maples, but if such an extreme example as hard maple worked well, I'm not as suspicious of them as of the spruces.

The main downside of American maples is their appearance. If making a violin that looks like a traditional one is important to you, you will need to choose carefully from the American woods. One type that's commonly used is west coast big leaf maple. This wood often has very dark grain lines, widely spaced, and the figure is different from European maple. This makes it immediately identifiable. Many makers have used this wood successfully, in spite of its appearance. One common defect of American wood is what my friends call "snot marks", which are featureless streaks in the wood, usually around 35mm long and 2mm wide, and what are called mineral streaks, which are very dark streaks of similar or smaller size. These aren't defects in a structural or tonal way, but are definite calling cards of your wood's source. Similar marks also appear in the maple of Chinese violins, which can be a liability if your customers make that particular connection.

Renegade woods deserve brief mention. I have tried cedar for violins, and though it works well on guitars, for violins it was a spectacular failure. There are a couple of Old World makers who used cedar (George Craske, for instance), and it didn't work well for them, either. It's seductive if you are making antiques, since it's naturally darker (older looking) than spuce even after staining. Tonally, it's shallow and harsh. In spite of that, it does work somewhat better on small-size (children's) violins. Cypress has been mentioned for tops, and I have not tried it.

Many successful instruments—mostly cellos and some violas—have been made with willow, poplar, and fruit tree woods (Swiss pear and cherry and some unidentified types usually just called "fruit wood" on certificates) instead of maple. I have seen poplar and walnut violins and didn't like the tonal results (too dull, and too bright, respectively), but cellos and violas have different rules, so who knows what might happen with them. Both Stradivari and the Rugeri family made many cellos with a type of willow or poplar, and a very large percentage of Joseph Guarneri filius Andrea cellos are of river willow. Italian river willow has a lot of minerals in it, which quickly dulls tools, and these Guarneri cellos are characterized by scratches all over their backs, from his having used ragged,

torn up scrapers for the final surfacing. I once made a viola from this wood, and though the resulting instrument was one of my best violas, it completely trashed all of my tools, so I won't be doing that again soon. Contemporary cello maker Gary Garavaglia has made a number of cellos with this wood.

In the American camp, two of the common off-beat woods used for larger instruments are tulip poplar and black willow. Tulip poplar is available in lumberyards, and when fresh it is white with green streaks that age into a beautiful warm brown. It's very inexpensive and available in boards wide enough for a one-piece cello back! Black willow is available from A&M Wood Specialties in Canada, and is an attractive wood very similar to the Cremonese version in appearance. Of the two, black willow is a brighter sounding wood, whereas poplar makes a warm and soft instrument—perhaps too much so.

English sycamore and beech (an attractive wood with very large and flashy cross-grain flecking) are both common and successful substitutes for maple in older European instruments. The English makers often used sycamore, and there are even a few beech Cremonese violins. When you start wandering off the spruce/maple path, you're on your own, and I don't recommend that you do this until you have made enough violins to know what a “normal” violin of yours sounds like, and can then evaluate the changes that come from different woods.

Finally I switched permanently to the normal European woods, which I don’t regret doing. First, they just look right, having all the right visual characteristics associated with fine old violins. Second, in my hands, at least, they sound consistently better, in the most subtle way: tonal variations. The violins I made with American tops were never criticized for their overall tone or volume, but players consistently commented on their lack of complexity in response to differences in bowing technique. A number of American makers use American woods and find them completely satisfactory, however, so this may only have to do with the peculiarities of what I do.

From a modern standpoint, the quality of the woods used by the classical makers is all over the map. Name a flaw, and I’ll find you an important Italian violin that has it--run-out, bad quartering, knots, and wildly uneven grain widths are all there, as well as sap pockets filled with patches, glued on wings and everything else. I once worked on a Testore cello with an eight-piece top with a couple of slabbed pieces in it! None of these defects has a bit to do with, or should I say, against, tone and structural stability. One thing you don’t see in good violins is spalting (black marks from fungus), and mineral streaks, so that’s where I personally draw the line. One thing that is common on old violins from certain makers (Lorenzo Storioni comes immediately to mind) that I don’t like, and won't use, is maple with wild grain patterns that look like crotch or burled wood, or the wood that's taken from the compressed and distorted underside of large branches.

Maple with unusual twists and turns in the wood is likely to shrink and warp in odd and random ways, causing lumpy archings and open, distorted center seams that can't be easily re-closed. I once had to repair the center seam of the back of a cello that had a 5mm gap in the joint in the lower third of the back, only. This was where a patch of this type of irregular wood was. The very bottom of the joint was closed, as was everything above the center of the c-bouts, but the lower bout part of the seam looked like someone had pulled open a slice of curtain into a gap that was closed at both the top and bottom. This type of thing is very difficult to repair!

Good quality European violin woods are available from many sources. Most violin wood comes from Germany and the southern parts of Eastern Europe. Good European wood can be expensive, and there are always persistent rumors that some European wood comes originally from the US and Canada. I can't tell you specific ways to tell the difference, but instead I recommend you find a source of wood that does the job for you, and stick with it, whether it's the European wood I think I'm buying and prefer, or the New World wood that many makers are happy to use. When you find something you like, buy as much of it as you can afford—it may not be there the next time you're shopping.

Age

There's a moderate difference of opinion as to how long violin wood should be aged before use. No source says less than three years, many makers boast of using none younger than five or seven, or ten (I suspect that actually makers draw the line just a bit newer than what they have access to) and those with access to it prefer the oldest wood they can get. It seems that the tops Stradivari used were as old as 60-80 years and more. On the other hand, del Gesu's wood was so fresh, he might almost seemed to have started carving while the tree was still standing—dendrochronolgy dates some of it on the short side of three or four years, at the maximum.

The furniture maker's rule-of-thumb is one year of drying per year of thickness, which probably means two years is the lower limit for functional stability in violin wood, given the dimensions of the various pieces. At that time most of the free water in the wood is supposedly gone, and it's no longer as prone to shrinkage and distortion. That's about the schedule del Gesu seems to have been on. There are many things going on in the wood beyond that initial drying, however. The most important may be the continued loss of non-water liquids (solvents, such as turpentine held in the resin take a long time to evaporate completely), and the subsequent hardening and oxidizing of the resins that hold them. Also, there are further things happening to the wood structure itself, over very long terms—conversion and off-gassing of things like the hemi-celluloses, for instance. There are also indications that wood tends to shrink and expand less over time as a result of what's been termed "humidity cycling"—alternating periods of dry and wet through the

years, and the further loss of volatile components. All of these probably help to contribute to the better results attributed the use of older woods.

Of course such changes don't stop when the wood has been made into a violin, and this accounts for some of the special qualities of old violins—that the wood in them has been curing for hundreds of years. On the other hand, we can't blame the performance of the best violins on their simply being old: there are more than enough old and bad violins to disprove that idea.

I've seen wonderful results that could be directly traced to the use of 60 year old wood, and don't doubt that such wood can make great violins in skilled hands. However, there's not much of that around, and I believe it should be reserved for the best violins, not one's first attempts, where its subtle features will be essentially wasted.

Drying

Tradition dictates that wood for musical instruments must be air-dried. In practice, this is not necessarily respected by wood dealers, for commercial reasons. I have been told that virtually all the wood that you might buy has been force-dried to some extent as a necessary part of avoiding damage from fungus. This may be more or less gentle, depending on the source.

Whether this is a real liability is vastly unclear. Most of the bad things I have read about forced drying is in old books and has been mindlessly repeated ever since, but modern drying methods are much more sophisticated than in the past, when those books were written. Look in any lumber book from the beginning of the 1900s and you'll find a wealth of horror stories and lovely illustrations of defects that I have never seen in anything at the local construction supply store. The initial days of kilning wood must have been brutal and experimental, and the chance of problem results is much less now than then. At any rate, all of the renegade woods you are likely to encounter have been commercially processed and kilned, unless you are buying from obscure sources, and makers have been using these without problems for a few decades now without giving the matter a whole lot of thought. I'm forced to draw the conclusion that among all of the things to worry about this issue belongs near the bottom of the list, in spite of the "collective wisdom".

Grain

The wood that the finest old violins are made of defies some common preconceptions. For instance, many people reflexively associate fine grain with high quality in spruce. Fine grain is not, however, a characteristic of the tops of the best violins. Most of the

classical makers chose spruce of medium to wide grain spacing. The best of J.B. Guadagnini's violins are made of extremely wide-grained wood, and Italian cello tops are usually made of wider-grained wood. Fine grain wood has been popularly attributed with greater strength, but research specifically into this has shown that this is not true: there's no correspondence between grain width and cross-grain strength and stiffness. Fine-grain wood is, however, usually heavier, and excess weight is definitely negative. This, alone, is reason to stay away from it. Another reason is that under varnish it's not as interesting or attractive, since some of the most visually interesting things in spruce happen in between the dark grains.

Maple in old violins, however, is often extremely fine grained. Such wood is nearly impossible to obtain now, and it does not appear that grain width is an important tonal factor in maple, however if there's a choice to be made when choosing maple, all other things being equal, I'd pick the finer grained examples.

In both cases, straight grain is desirable; in the top, for appearance, and for stability in maple, which tends to deform directly in relationship to non-uniformity.

Another factor to consider is the consistency of the grain. Though it's not usually a structural defect, there's a definite prejudice against wood with widely-varying grain width from inch to inch unless it's particularly attractive. A gradual and even change from one side of a piece to the other edge is fine, though, and old violins often show a considerable difference in grain width between the center seam of the top and the outer edges (because of the way spruce trees grow, the widest grains are usually towards the outside).

Quartering and Run-out

The two parameters of wood quality which are definitely among the most important for tonal results are quartering and run-out. Quartering is the alignment of the grain lines when viewed from the end of the plate of wood. Perfectly quartered wood has the grain lines at a perfect square to the surface. This is what gives the top its appearance of long straight lines of grain from one end to the other. The opposite of quartered is slabbed. Slab-cut wood has the grain lines parallel to the surface. A great example of slabbed wood is plywood, which rather than showing lines as the figure shows circles and various shaped pools of grain lines running in vaguely oval shapes. Oak floors often show both types of wood, and also the third and harder to recognize semi-slab (or semi-quartered) variety. The important thing to realize is that quartered wood is the strongest against bending, slabbed (which is sometimes used on the back but never on the top) is the next strongest and functionally very similar to quartered, but semi-slabbed wood, or quartered wood cut inaccurately and off quarter, is the very weakest and least stiff. Where

quartering or lack of it can be compensated for to a degree in maple by using thicker graduations, it's a definite defect in the spruce for a top, and should be avoided.

Spruce from smaller trees, such as used by the early Italian makers, can change in quartering from one surface to the other because the rings of smaller trees are smaller circles than on large ones, and any deviation from perfect alignment results in imperfect quartering. The Cremonese makers had a clever way of compensating for this, by flipping one side of the top end-for-end, resulting in wood which is perfectly quartered at the ribs, and also perfectly quartered across most of the arching, even though it is running at an angle to the ribs in those areas. This is the most desirable orientation and is found only in the Cremonese school. The illustrations and photos above clarify how this works.

The earliest violin makers flipped one side of the back, too, maintaining quartering on both sides of the back, but after Nicolo Amati this practice was abandoned. It's obvious when this has been done because instead of the curled figure running in the familiar chevron pattern up or down to the back's center seam, the figure just continues on in the same direction on the other side of the centerline. They must have decided at some point that there was no tonal penalty for less than perfectly quartered back wood, and that they preferred the appearance of what we now regard as a normal chevroned pattern, because virtually all makers after about 1650 abandoned the practice of flipping one back piece relative to the other.

Slabbed top wood is never used (though there are some ancient instruments in which this has been beautifully utilized), but all makers have used slabbed maple at times. The disadvantages of this are that slabbed wood expands and contracts more than quartered with humidity changes, and that it is slightly less springy and strong in this direction. Consequently, makers using slabbed backs often attempt to compensate by making them 10% or 20% thicker. This doesn't really work, and slabbed back instruments are usually softer and less aggressive in personality. As a consequence of humidity changes, old slabbed backs usually have more cracks than their quartered relatives, particularly around the edges at the top and bottom where cross-grain expansion and contraction has been restrained by the bracing effect of the ribs. Something has to give there, and it's often the back, not the restraining glue joints.

Run-out is another non-subjective wood quality failure. This results when the tree grows with a twist, but the wood blanks for tops or backs have been sawed out straight in line with the body of the tree. When the wood is opened and glued together for a top or back, along the length of the plate the grain will be running uphill and out of the surface on one side of the centerline and downhill and into the surface on the other side. No flipping can cure this imbalance if the wood has been cut into the normal violin wedge form. Wood cut with this defect is unpredictably weak, in an unbalanced and irregular pattern, and has

the cosmetic defect of flashing dark on one side of the top or back and light on the other as the lighting changes around the instrument, something that's called “harlequin” wood in the trade.

The highest quality violin woods are sold split, rather than sawed. The split will follow the run-out, resulting in pieces without run-out. On large trees this works well, but it's less effective on small ones because the degree of twist varies with the tree stem's diameter within the same tree, and so split wood can result in a piece which has no theoretical run-out, but which is substantially twisted from one end to the other. Planing such wood flat for use results in a compromise of wood that has runout either in the center or at the edges, but it cannot be perfect everywhere. If it's necessary to use such wood, it should be planed so that the run-out is at the edges, not along the center seam.

Wood with no run-out at all is difficult to find, and expensive. Usually makers set their own limit on what they're willing to use in regard to this problem.

Density

Apart from its visual characteristics, wood growth varies in density, which is expressed as weight per volume. There's some disagreement among makers as to which particular lighter densities are desirable and how light is too light, but no one disagrees that heavy top wood is not good. I avoid wood which feels heavy in my hand for its size, and wood species which are known for being dense (Douglas Fir is an example of an attractive softwood which is too heavy for violin making).

I don't go to great effort to determine density precisely, though. The practical shop method for determining density is to first weigh a candidate piece of wood, then fill a marked container with water, plunge the wood in until it's submerged, and measure its volume by the rise of the water, in ccs or ounces. From that, with a bit of math wrestling, you can calculate the density, in pounds per square foot or the units of your choice.

Choosing Wood for Your Violin

For initial attempts I’d recommend relatively plain wood, because working it well demands a much lower skill level, so there's less chance of making mistakes. Highly-flamed ribs are very difficult for a beginner to bend, and break easily on the curls. That’s one good reason to start with nice but not excessively decorative wood. Highly-figured backs and scrolls are more difficult to carve because with figured wood by necessity much of the work is against the grain. Many classical period violin makers used very plain wood at times, and even the best of those makers usually made the neck and scroll from relatively plain stock that was sometimes even nearly free of figure, since unlike the

back, the scroll requires carving in all sorts of directions, and because of the shape you often can't choose the best direction and angle for carving with the fewest problems.

There's a lot of folklore about wood choice. Some makers choose pieces that ring, some want a particular type of ring, some want wood that doesn't ring at all; some demand hard grain lines in their spruce and are very particular about grain width, some are very particular about run-out and quartering and some makers don't care about any of this, and use the wood that's in front of them. I'm mindful that while Stradivari probably was concerned with wood density, he most likely had no way to calculate it to the three decimal point degree that seems so important to modern makers. There are many scientific studies on the measurable qualities of wood, but virtually none having to do with which qualities really make the best violins. With regard to the tapping of pieces, Robert Bein, a very clever and observant person, once commented to me that it's seductive to believe that the pieces of a musical instrument should themselves have a musical sound, but there's absolutely no concrete evidence that it makes any difference whatsoever. Thought exercises can't replace experience in this regard; intuition is no substitute for research and experience. As I have mentioned previously, obvious defects indicate potential problems, and should be avoided. Generally, wood is priced according to the seller's perception of its quality, which is a good start, but not totally reliable.

Gradually, makers develop their own preference for these things. It's difficult to say that which qualities have a material effect on tone, however, especially if the maker has strategies that take them into consideration. I'm reminded, for instance, of one of the finest sounding Stradivari violins I've seen, which had such extreme run-out on the back that when photographed normally one side would reflect light strongly, and the other side looked very dark, requiring one side to be lit from above, and the other from below! On top of that, it may have been the plainest piece of maple I've ever seen on a Strad. Whatever Stradivari had done with that mongrel piece of "bad" wood, it was right.

Many great (and now expensive) violin makers of the past used wood that today would be immediately rejected by modern makers. Don't be seduced into believing that ideas which sound good are therefore good—get some experience and test those ideas for yourself. Therefore, I'd say don't get too hung up on wood until you have some experience in using it: instead, get some wood and move on to making the violin.