How did I get here?

Ross Nelson, NASA-Goddard, 618
Sept. 2012, Silvilaser/Vancouver - First Return

What country was responsible for much of the early work in laser altimetry, who was the first scientist to look at a vegetation profile generated by a laser, who first related laser ranges to forest structure? The purpose of this paper is to look back 3+ decades ago when forestry lidar was in its formative years and to give credit to those who first thought to employ a laser to measure the Earth's surface. As with much scientific research, advances were often made independently and concurrently in a number of countries. Functioning lasers were first demonstrated in 1960 in the USA and in 1961 in the USSR, but research into the use of lasers as forest measurement tools did not begin for another 15 years. Initially, with respect to Earth resources, lasers were employed to measure sea ice surface roughness, to make near-shore bathymetric measurements, to penetrate forests to make detailed topographic measurements, and to fluoresce oceanic phytoplankton for surface current studies. Some of these early studies noted that forest profiles were evident but in fact added noise to topographic retrievals. Trees became the signal rather than noise in 1976 when researchers in the Canadian Forest Service went to an IUFRO conference in Oslo and reported on efforts to better estimate timber volume in tropical forests. They employed large-scale airphotos (1:500 up to 1:4000) to measure the top of the tropical canopy, an avionic radar to measure the location of the ground beneath the canopy, and a barometric sensor to record aircraft/radar height above a datum (e.g., sea level). Their radar did not work well in dense vegetation and mentioned in passing that a laser altimeter had worked well in Canadian forests. But in a report 2 years later they reported that, on a study area in Costa Rica, the radar ground line was much improved and no mention is made of a lidar altimeter. In the USSR in 1977, Russian researchers felled a birch and a spruce, aimed a helium-neon, 0.63 um laser with a spot size of ~25mm, at the horizontal trees, produced a profilograph, compared it to tape measurements, and concluded that, with increased power, such a laser could be mounted on an aircraft to remotely measure forest canopies. In 1979, they mounted their He-Ne laser on an AN-2 biplane and acquired their first airborne profiles. Scientists with TRANARG, a mapping/surveying company in Caracas, Venezuela, reported on 1976 flights employing a helium-neon lidar to collect over 11,000 km of lidar profiles spaced 1.5 km apart in order to construct a topographic map to help site a new reservoir. They noted 35-40 m median canopy heights with emergents up to 55 m in their profiles. These studies and others that utilize these height and canopy density metrics for forest mensuration are reviewed in this glance backwards at the history of forestry lidar.