

Regional Baseline Rationales – 1990 versus 2005

Northern Region (R1): The Northern Region (R1) has selected the 1990-2013 baseline. Although the FIA plot design and layout has changed over the years, this dataset is a statistically-valid sample regardless of the sample design utilized. Furthermore, R1 has been using this data for over 10 years to monitor vegetation characteristics and this analysis would add value to the Region's analysis.

Rocky Mountain Region (R2):

Region 2 has decided to use the shorter version of the baseline, from 2005-2012. Our rationale is based largely on input from subject matter experts in the FIA program. At the moment, we do not think the Region has a pressing need to go back 1990s to establish a longer trend. Also, the longer baseline graphs show carbon stock movement that cannot be explained through management or disturbance. Our understanding is this has to do with interpolation, extrapolation, or some other sampling or compilation artifact. There are fewer of aberrations with the shorter baselines.

Southwestern Region (R3):

As detailed in Appendix A-1 of Woodall *et al.* 2013, the data used to construct the earlier portion of the 1990 – 2013 time series were collected in support of the Renewable Resources Planning Act (RPA) and data used to construct the latter portion were collected via the Forest Inventory and Analysis (FIA) program. While the integration of these two data sources may be the best method available to represent patterns in carbon storage in vegetation over this longer time series, a better approach would be to constrain our time series to that for which we can rely on a single data source, or upon data sources that meld better than these do. Though the shorter, 2005 – 2013 time series shares some inherent issues present in the longer time series as well (such as changes in FIA protocols over time, reliance on periodically rather than annually collected data, and initialization with RPA data), it suffers from fewer data integration problems. Given these constraints, at this point in time we recommend using the shorter 2005 – 2013 time series of carbon stock estimates in order to reduce the error resulting from the integration of disparate data sources.

Intermountain Region (R4):

The periodic inventories that allowed interpolation through the 1990s had issues that caused the CCT team to implement some measures that filled in missing data. This involved making some assumptions and introduced an order of uncertainty that isn't present with the more consistently measured annual inventories. The documentation gives at least a sampling of the specific problems going back in time, and FIA's Sara Goeking has done some work in ID that might identify other difficulties. If there aren't trends in management or disturbance that you urgently want to track prior to 2005, you might be better off sticking with the 2005 baseline.

Pacific Southwest Region (R5):

For Region 5, the estimates are based on a combination of map-based estimates provided by R5 for the Resources Planning Act (RPA) reports of 1987 and 1997, a vegetation-map stratified inventory conducted by R5 using data from 1993-2000 and compiled by FIA (Waddell and Hiserote 2005), and an annual inventory conducted by FIA from 2001-2013. Chaparral was considered a type of forestland in the 1990s but not in the annual inventory, and was removed from the pre-annual compilation of data. Nevertheless, the differences in estimated area of forestland across inventories are dramatic, leading to an apparent gain and loss of more than 1 million acres of forestland in the 1990-2013 assessment. These changes in area of forest lands affect all subsequent calculations of carbon stocks and changes in the report.

While discrepancies between inventories may to some extent “average out” at the scale of all forested lands in a state or nation, they can become evident in summaries at the NFS unit level. Given the unreconciled differences with the previous inventories, it may be preferable to only report the 2005-13 instead of the 1990-2013 trend lines. The trend lines and change estimates may still be affected by the older information however. For the unreconciled analysis, the most reliable information would be the carbon stocks and densities for one cycle of the annual inventory (average of 2004-2013 sample data).

Pacific Northwest Region (R6):

The Pacific Northwest Region has chosen the 2005 data point to serve as the regional baseline for the following reasons:

- While the 1990 data reflects a longer period of record from which to infer changes in carbon (flux), the methodology shift in sample design for data presents potential for misinterpretation of carbon trajectories. This anomaly is most notable for the time period from 1990 to 1996, and is indicative of lack of consistency in the sampling methodology prior to 2000. Conversely, the 2005-2013 data does not present the same data irregularities, and therefore is more appropriate for our carbon accounting purposes.
- Most national forests in Region 6 published Land Management Plans in or around 1990 with major amendments in the years that followed. As a result, the 1990 baseline is largely indicative of a baseline that resulted from management that differs from current management direction and emphasis. This legacy of previous management that shows in the 1990 baseline is therefore not reflective of current land management plans and large sub-regional amendments such as the Northwest Forest Plan and Eastside Screens.
- The year 1990 is often looked at as a key year demarking a shift in climatic regime. Thus, the 1990 baseline is more indicative of a legacy climate rather than the contemporary climate. The region feels that the 2005 baseline better reflects a baseline indicative of the contemporary (albeit changing) climactic conditions.

Southern Region (R8):

In terms of available data used for the Region 8 assessment, both the periodic and annualized FIA data are sound bases for assessing carbon stocks. The transition between the two inventory protocols is not seamless, but has been dealt effectively in the estimates in the report. In this regard an earlier baseline than 1990 would be possible.

There are two factors to consider when using FIA data from both periodic and annualized inventories. The first is that total NF acreage varied from survey to survey. The periodic inventories, which finished in the late 1990's or early 2000's depending on the state, controlled for NF area, that is, a fixed, known area was used when making forest area estimates. The subsequent periodic inventories, however, did not use a fixed, known NF area. Rather the NF area is determined by the plots that fall in the forests and varied somewhat from year to year. Therefore, NF forest areas have not been consistently reconciled with actual ownership records.

Second, the periodic forest inventories only installed field plots in timberland, excluding any reserved land such as wilderness areas within NF. The periodic inventory volume, and therefore carbon, estimates were made from plots that only fell within the non-reserved parts of the NF. Still, if one is willing to accept the assumption that carbon density estimates on reserved areas of NFs are comparable to those on non-reserved areas, then the periodic inventory carbon estimates are accurate.

So both the FIA area estimates and plot measurement protocols introduce variance in the carbon stock estimates and change results. But in our opinion the greater of the two concerns is that of varying NF area, so the 1990 data is actually slightly better for use as a baseline than more recent data.

Eastern Region (R9):

The Eastern Region has selected the 2005-2013 baseline after consulting with our FIA representatives. We selected this baseline because we have more confidence in the consistency in data collection over that time period. Although the periodic inventories conducted by FIA in R9 prior to 2005 are not as fraught with inconsistencies found out West, there is still some concern. We are mainly concerned about differences in coverage and protocols in different places at differing times. Differences in FIA's periodic versus annual inventories can result in perceived changes of forest resource estimates over time that are actually the result of program changes as opposed to real world changes.

Areal coverage and protocols were much more consistent under the annual inventory starting in some states in 1999 and implemented everywhere in R9 over the next few years. Uncertainty estimates also appear to be different prior to 2005, making it seem as though uncertainty was lower for earlier time periods. According to FIA staff, their estimates of uncertainty could be even larger for those earlier periods, but they are out of development time with the old accounting system. Also, many FIA personnel who were around in the days of periodic inventories have either retired or do not recall much about how the data were collected. Thus, annual inventories (such as those available from 2005 onward) will be the sole source of information for decision-making in international negotiations.

Alaska Region (R10):

For Region 10, the estimates are based on a periodic inventory conducted by FIA from 1995-2003, and an annual inventory conducted by FIA from 2004-2013. Wilderness areas were measured for one year (1/10th of the plots) in 2005. The only adjustment done for the NGHGI was to treat Wilderness separately. Any assessments of change in the 1990-2013 timeline are primarily based on differences between the periodic and annual estimates for non-Wilderness forested lands. However, the annual inventory applied a nationally-standardized definition of "forest land" which included Krummholz as forest and used a stocking threshold rather than a cover one. This resulted in an apparent increase in area of forest lands, which affects all subsequent calculations of carbon stocks and changes.

While discrepancies between inventories may to some extent "average out" at the scale of all forested lands in a state or nation, they can become evident in summaries at the NFS unit level. To detect real change in forest land area, it would be necessary to do a plot-by-plot analysis of locations sampled by both the periodic and annual inventory for examples of forest loss or gain from river erosion/deposition or road-building/decommissioning, or meadow invasion, while attempting to adjust for the change in definition. This is the type of analysis that went into the FIA 5-year report.

Given the unreconciled differences with the previous inventory, it may be preferable to only report the 2005-13 instead of the 1990-2013 trend lines. The trend lines and change estimates may still be affected by the older information however. For the unreconciled analysis, the most reliable information would be the carbon stocks and densities for the annual inventory period (average of 2004-2013 sample data).

Please contact Karen Dante for additional information and questions (skdante@fs.fed.us, 202-403-8987).