# Longleaf Pine Cone Prospects for 2021 and 2022

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During the spring of 2021, cone production data were collected from selected low-density (e.g., shelterwood) stands of mature longleaf pine, throughout its native range. Binocular counts of green cones and unfertilized conelets were conducted on the crowns of sampled trees, as viewed from a single location on the ground. Visibility of cones and conelets on each tree is enhanced when the observer stands with their back to the sun. A breeze that moves the flexible pine needles about also helps the relatively more rigid cones and conelets standout for the observer. The near-term regional averages and individual site averages for these counts are reported in Table 1.

Table 1. Estimated Longleaf Pine Cone Production.

| Cooperator | State and County | Estimated cones per tree from green cones for fall 2021 | Estimated cones per tree from conelets for fall 2022 |
|---|---|---|---|
| Kisatchie National Forest | Louisiana, Grant | 23.6 | 36.4 |
| T.R. Miller Woodlands | Alabama, Escambia | 9.6 | 19.1 |
| Blackwater River State Forest | Florida, Santa Rosa | 11.2 | 64.3 |
| Eglin Air Force Base | Florida, Okaloosa | 0.8 | 43.3 |
| Apalachicola National Forest | Florida, Leon | 0.2 | 14.3 |
| Jones Ecological Research Center | Georgia, Baker | 55.6 | 63.6 |
| Tall Timbers Research Station | Florida, Leon | 6.2 | 30.8 |
| Fort Benning Military Base | Georgia, Chattahoochee | 5.7 | 44.7 |
| Sandhills State Forest | South Carolina, Chesterfield | 40.0 | 11.5 |
| Bladen Lakes State Forest | North Carolina, Bladen | 49.7 | 10.8 |
| Ordway-Swisher Biological Station | Florida, Putnam | 2.4 | 27.6 |
| Region Averages | | 18.6 | 33.3 |

**Regional Summary:**

The regional cone crop, based on green cone counts, is **poor for 2021**, at 18.6 cones per tree. The natural variation, typically seen across the native range of longleaf pine, is apparent in this year's data, with six sites having failed crops, two sites poor crops, two sites fair crops and one site a good crop. A bumper crop ($\geq$ 100 cones per tree) was not observed anywhere. A good crop (50 to 99 cones per tree) was present in Baker County, Georgia. A fair crop (25 to 49 cones per tree) was present in Chesterfield County, South Carolina and Bladen County, North Carolina. A poor crop (10 to 24 cones per tree) was present in Grant Parish, Louisiana and Santa Rosa County, Florida. Failed crops (<10 cones per tree) were noted in Escambia County, Alabama, Okaloosa County, Florida, Leon County, Florida, Chattahoochee County, Georgia, and Putnam County, Florida.

The regional cone crop outlook, based on counts of unfertilized conelets, is **fair for 2022**, at 33.3 cones per tree. The cone crop is forecasted to be a good crop at two sites, a fair crop at five sites and a poor crop at four sites, reflecting a good deal of natural variability. However, keep in mind that cone crop estimates based on counts of unfertilized conelets are less reliable than those based on counts of green cones, because of conelet losses during their first year, with often fewer than half surviving to become green cones during their second year.

The 56-year regional cone production average for longleaf pine is about 28 green cones per tree. The single best cone crop occurred in 1996 and averaged 115 cones per tree. Good cone crops were observed in 1967 (65 cones per tree), 1973 (67 cones per tree), 1987 (65 cones per tree), 1993 (52 cones per tree), 2014 (98 cones per tree) and 2017 (62 cones per tree). Fair or better cone crops have occurred during 46% of all years since 1966, with an increased frequency since the mid-1980s. Reasons for this increasing frequency may be related to environmental change or management factors (or a combination of these). Research analysis of these long-term data has resulted in the recent publication of scientific articles, which provide new insights into the reproductive pattern of longleaf pine in an environment with increasingly variable conditions. Electronic portable document files (pdf) of these articles are included along with this report:

Chen, X., Brockway, D.G., Guo, Q., **2020**. Temporal patterns of pollen shedding for longleaf pine (*Pinus palustris*) at the Escambia Experimental Forest in Alabama, USA. *Dendrobiology* (84): 30-38.

Chen, X., Brockway, D.G., Guo, Q., **2020**. Burstiness of seed production in longleaf pine and Chinese torreya. *Journal of Sustainable Forestry* DOI: 10.1080/10549811.2020.1746914

Clark, J.S., Andrus, R., Aubry-Kientz, M., Bergeron, Y., Bogdziewicz, M., Bragg, D.C., Brockway, D.G., Cleavitt, N.L., Cohen, S., Courbaud, B., Daley, R., Das, A.J., Dietze, M., Fahey, T.J., Fer, I., Franklin, J.F., Gehring, C.A., Gilbert, G.S., Greenberg, C.H., Guo, Q., HilleRisLambers, J., Ibanez, I., Johnstone, J., Kilner, C.L., Knops, J., Koenig, W.D., Kunstler, G., LaMontagne, J.M., Legg, K.L., Luongo, J., Lutz, J.A., Macias, D., McIntire, E.J.B., Messaoud, Y., Moore, C.M., Moran, E., Myers, J.A., Myers, O.B., Nunez, C., Parmenter, R., Pearse, S., Pearson, S., Poulton-Kamakura, R., Ready, E., Redmond, M.D., Reid, C.D., Rodman, K.C., Scher, C.L., Schlesinger, W.H., Schwantes, A.M., Shanahan, E., Sharma, S., Steele, M.A., Stephenson, N.L., Sutton, S., Swenson, J.J., Swift, M., Veblen, T.T., Whipple, A.V., Whitman, T.G., Wion, A.P., Zhu, K., Zlotin, R., **2021**. Continent-wide tree fecundity driven by indirect climate effects. *Nature Communications* DOI: 10.1038/s41467-020-20836-3

**Evaluating Longleaf Pine Cone Data:**

Observations, concerning the natural variation in longleaf pine cone crops, and field studies, determining of the amount of seed (i.e., number of productive cones per tree) required to successfully regenerate even-aged shelterwood stands, resulted in development of Table 2. The minimum cone crop needed for successful natural regeneration, using an even-aged management technique such as the uniform shelterwood method, is 750 green cones per acre. This assumes

30 cones per tree, with 25 seed-bearing trees per acre. Thus, cone crops classified as "fair or better" represent regeneration opportunities, for which a receptive seedbed may be prepared through application of prescribed fire during the months prior to seed fall in October.

Table 2. Classification of Longleaf Pine Cone Crops*.

| Crop Quality | Cones per Tree | Cones per Acre (on 25 trees per acre) |
|---|---|---|
| Bumper crop | $\geq$ 100 | $\geq$ 2500 |
| Good crop | 50 to 99 | 1250 to 2475 |
| Fair crop | 25 to 49 | 625 to 1225 |
| Poor crop | 10 to 24 | 250 to 600 |
| Failed crop | < 10 | < 250 |

* Cones on mature trees (14-16 inches at dbh) in low-density stands (basal area < 40 $feet^2$/acre).

When uneven-aged management stand-reproduction methods such as single-tree selection and group selection are being used, then "seed rain" incident on a site every year, although of variable intensity from year to year, is often sufficient for successful natural regeneration. While using selection silviculture frees one from dependency on the timing of good cone crops, it may nonetheless be useful for the manager of uneven-aged stands to be aware of cone crop quality from year to year when making management decisions.

It is also worth noting that a good deal of spatial variation occurs among longleaf pine stands across the Southern Region, relative to cone production. Therefore, even during a year with a lower overall regional average number of cones per tree, certain localities can experience substantial longleaf pine cone production. This regional report is intended as a guide, which broadly forecasts the overall status of longleaf pine cone production. Thus, we encourage forest managers to take binoculars to the field and carefully examine any individual stands in which they have an interest. In this way, they can, for those specific stands, acquire more detailed site-specific information that will aid them in making management decisions.

**Study Partners:**

- Kisatchie National Forest, Pineville, Louisiana
- T.R. Miller Woodlands, Brewton, Alabama
- Blackwater River State Forest, Milton, Florida
- Natural Resources Management, Eglin Air Force Base, Niceville, Florida
- National Forests in Florida, Tallahassee, Florida
- J.W. Jones Ecological Research Center, Newton, Georgia
- Tall Timbers Research Station, Tallahassee, Florida
- Land Management Branch, Fort Benning Military Base, Columbus, Georgia

- Sandhills State Forest, Patrick, South Carolina
- Bladen Lakes State Forest, Elizabethtown, North Carolina
- Ordway-Swisher Biological Station, Melrose, Florida

**Data Collection Cooperators:**

> Michael Low, Natural Resources Management, Eglin Air Force Base, Niceville, Florida
> Stephen Hudson, Land Management Branch, Fort Benning Military Base, Columbus, Georgia
> David Schnake, North Carolina Department of Agriculture & North Carolina State University Research Stations, Raleigh, North Carolina
> Stacey Sleek, Ordway-Swisher Biological Station, University of Florida, Melrose, Florida
> Alan Springer, Southern Research Station, USDA Forest Service, Pineville, Louisiana
> Jacob Floyd, Southern Research Station, USDA Forest Service, Pineville, Louisiana

**Cone Counting Method:**

The following procedure and field data sheet are provided for those who may wish to conduct field observations of longleaf pine cone production in their own locale. Remember:

- **Conelets** indicate how much production *may* happen <u>next</u> year (see Figure 1).
- **Green cones** tell you how much production will happen <u>this</u> year (see Figure 2)
- Brown cones tell you how much production occurred <u>last</u> year.

Figure 1. Two **conelets** on a longleaf pine branch, on either side of a bud.

Figure 2. Two **green cones** on a longleaf pine branch, as they would appear in spring.

- Equipment: 8 to 10x binoculars, field data sheet, clipboard, pencil, d-tape, tree tags, aluminum nails, hammer, tree flagging, bark scraper and tree paint.

1. Locate a stand that is growing at a shelterwood density of less than 40 square feet per acre (25 to 35 square feet per acre is a typical range) and contains numerous trees of at least 10 inches at dbh. Better cone crops generally come from larger-diameter trees and poorer cone crops come from smaller-diameter trees. A key consideration is that high brush and/or trees cannot obscure the crowns of your sample trees, or your data collection will be impaired. The midstory must be relatively open, so you can see the entire crowns of sample trees.

2. Select at least 10 trees in the stand to serve as your representative sample for monitoring, by painting a ring around the tree at dbh or higher and a sequence number on each (use a color other than white to avoid confusion with the white rings often painted around trees having RCW nests). You may also attach a metal tag to the tree using an aluminum nail, but attach this high enough so that the tag number will not become obscured by char from or, even worse, melted during prescribed fires (this happens when tags are too low).

3. Using the field data sheet, enter the following data at the top: location, date and crew. Then for each tree: enter the tree number, measure its dbh in inches, and then record that measurement. Now, you are ready to count the green cones and small conelets.

4. Walk away from the tree and toward the sun. The precise distance away from the tree is not crucial, but it should be far enough away to give your neck a comfortable angle while looking up, but not so far away that you cannot clearly see the cones with 8 to 10 power binoculars. With the sun at your back, you may need to adjust your position a bit to the left or to the right, so that you can view the entire tree crown without moving from your counting location. An uncrowded midstory will be helpful at this point.

5. Work from the less difficult to more difficult strobili to see. First, count the number of green cones that can be seen from the single spot on which you are standing. We usually start at the lower left of the crown and work up to the top of the crown, then across the top of the crown to the right and then down the right side of the crown all the way to the bottom-most branches. This is a systematic approach that scans across the entire crown (left half, top, right half) and leads to consistently accurate counts. Once you have done this, enter the number of green cones into the data sheet.

6. Because these developing cones are green, they are more difficult to see against the green pine foliage. It helps to count these green cones (and other structures) on a bright sunny day, when the light is good. It also helps if there is a light breeze blowing that moves the pine needles about, thereby revealing the more rigid cones. This is the most important count you will make, because these green cones contain the seed that will be shed during the upcoming October, and it is these data that will become the numbers upon which the cone crop forecast for the current year will be based (a forecast in which many land managers have a great interest). News of a good cone crop usually alerts forest managers to get busy during the summer, preparing seedbeds that will be receptive to capturing and deriving the most benefit from the upcoming seed fall. You will also note on the data sheet that the raw number you see in your green cone count needs to be multiplied by 2 at the end of the column. Many years of research by Bill Boyer confirmed that this adjustment to the raw count was needed to obtain an accurate estimate (the actual regression from his work approximated 1.98). In general terms he explained this need, because the cone count is performed by looking at only one side of the tree, thus the raw count for green cones needs to be doubled.

7. Finally, repeat the same up-over-down scan with your binoculars, counting the small conelets that can be seen from the single spot on which you are standing. They are smaller than the green cones, so it will take more time to locate them. But, they are up

there. These conelets were pollinated only one month earlier (during March), but will not become fertilized for almost another 11 months (until a pollen tube grows from the surface of the conelet deep into its ovary). These conelets are the basis for estimating what the cone crop might be during the following year. But, it is worth bearing in mind that conelet abortion happens in nature for a variety of natural reasons (e.g., genetics, disease, insects, adverse weather conditions). Thus, not all conelets will survive to maturity. In fact, the conelet mortality rate is typically more than 50 percent. So, this estimate for next year, based on conelets, is less reliable than the forecast for this year, based on green cones.

**Field Data Sheet:**

The field data sheet appearing on the following page can accommodate up to 24 sample trees. Spaces are provided at the bottom for summing the totals of each count and computing the average number of strobili per tree. Should you wish to collect data for a greater number of trees, multiple sheets may be used. However, this format can be easily created on a computer by using an electronic spreadsheet program, which can be vertically extended to provide ample room for a great number of sample trees, with summary spaces at the bottom.

**Regional Longleaf Pine Cone Study: Female Strobili Count - - Field Data Sheet**

Location: ____________________ Date: _________________ Crew: ____________________

| Tree Number | DBH in inches | Green Cones mature October this year | Conelets mature October next year |
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|---|---|---|
| Total = | | |
| Green Cones x 2 = | | |
| Number Per Tree = | | |

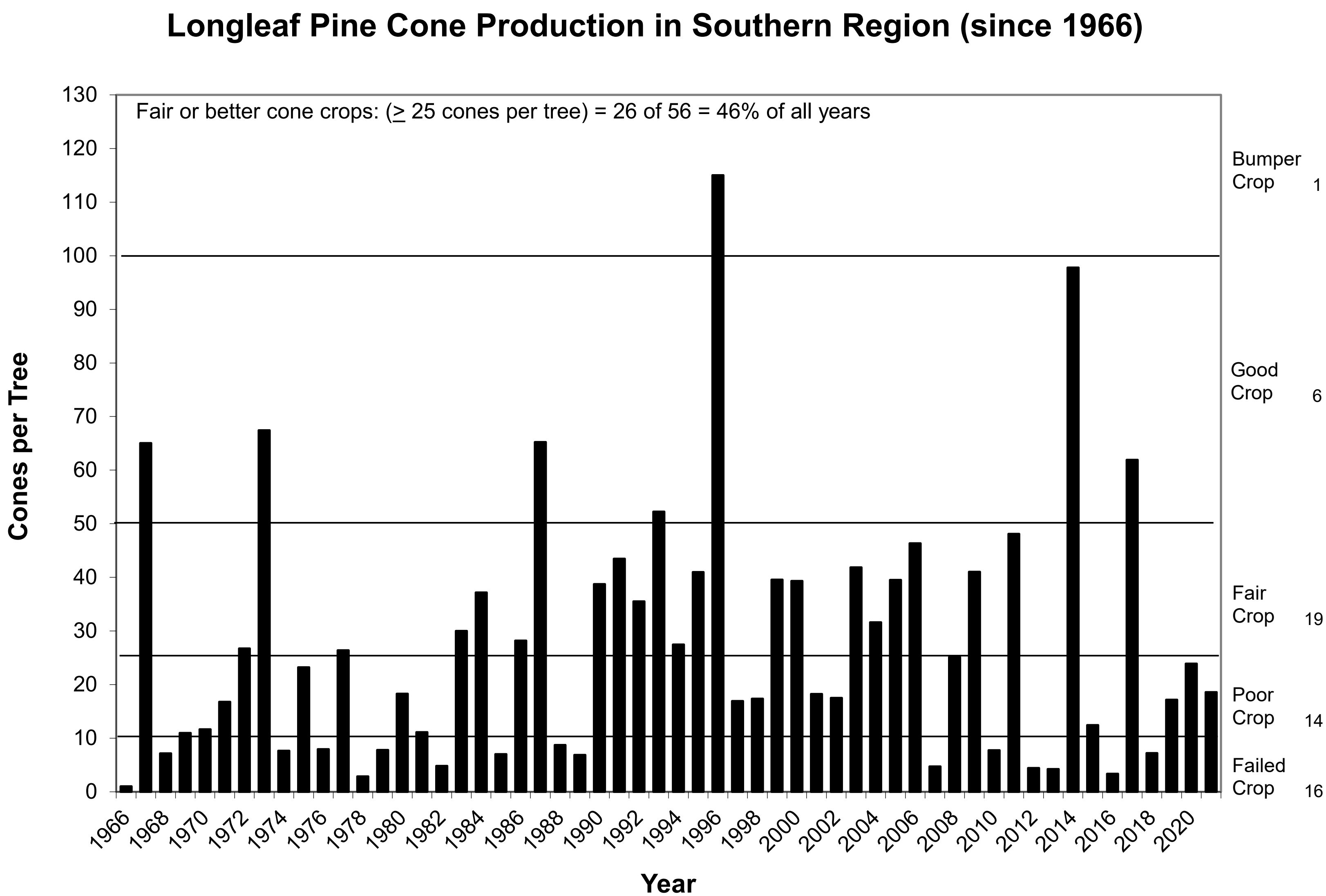
## Regional and Local

## Summary and Graphs

| Year | **Southern Region** | LA-Kisatchie National Forest | AL-Escambia Exp. Forest | W FL-Blackwater River State Forest | W FL-Eglin Air Force Base | W FL-Apalachicola National Forest | SW GA-Jones Res. Center | Red Hills-Tall Timbers Res. Station | W GA-Fort Benning Military Base | SC-Sandhills State Forest | NC-Bladen Lakes State Forest | FL Pen.-Ordway-Swisher Biological Station |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1958 | | | 63.0 | | | | | | | | | |
| 1959 | | | 9.0 | | | | | | | | | |
| 1960 | | | 19.0 | | | | | | | | | |
| 1961 | | | 43.0 | | | | | | | | | |
| 1962 | | | 8.0 | | | | | | | | | |
| 1963 | | | 1.0 | | | | | | | | | |
| 1964 | | | 12.0 | | | | | | | | | |
| 1965 | | | 4.0 | | | | | | | | | |
| 1966 | **1.0** | | 1.0 | | | 0.6 | | | | | | |
| 1967 | **65.1** | 26.4 | 53.4 | 13.8 | | 18.7 | 2.7 | | | | | |
| 1968 | **7.2** | 5.8 | 34.4 | 2.5 | 0.2 | 9.9 | 0.4 | | | | 0.2 | |
| 1969 | **10.1** | 10.1 | 15.8 | 2.5 | 0.6 | 5.2 | 0.8 | | | 9.2 | 1.9 | |
| 1970 | **11.7** | 13.6 | 2.2 | 1.7 | 0.9 | 1.0 | 7.5 | | | 7.1 | 0.9 | |
| 1971 | **16.8** | 4.8 | 21.6 | 29.2 | 4.1 | 14.4 | 1.5 | | | 10.2 | 2.7 | |
| 1972 | **26.7** | 8.3 | 5.4 | 0.9 | 3.5 | 0.2 | 0.4 | | | 51.0 | 25.6 | |
| 1973 | **67.4** | 55.6 | 28.3 | 14.4 | 10.6 | 27.2 | 7.2 | | | 92.0 | 8.8 | |
| 1974 | **7.7** | 1.9 | 24.7 | 3.0 | 1.6 | 9.6 | 0.3 | | | 6.7 | 0.3 | |
| 1975 | **23.2** | | 15.7 | 17.5 | 10.6 | | 5.0 | | | 67.3 | | |
| 1976 | **7.9** | | 3.9 | 1.5 | 1.7 | 22.9 | 1.6 | | | 16.1 | | |
| 1977 | **26.4** | 47.4 | 19.8 | 9.9 | 1.1 | 89.7 | 1.1 | | | 25.5 | 16.9 | |
| 1978 | **2.9** | 5.0 | 4.7 | 0.8 | 0.3 | 2.7 | 1.0 | | | 8.5 | 0.3 | |
| 1979 | **7.8** | 10.6 | 11.3 | 5.5 | 4.4 | | 3.1 | | | 18.4 | 1.4 | |
| 1980 | **18.3** | 67.3 | 3.0 | 0.5 | 0.6 | | 2.3 | | | 36.2 | | |
| 1981 | **11.1** | 13.6 | 6.6 | 1.2 | 1.0 | | 0.9 | | | 43.5 | | |
| 1982 | **4.8** | 0.7 | 13.1 | 3.2 | 8.1 | | 1.7 | | | 2.3 | | |
| 1983 | **30.0** | 94.2 | 14.6 | 11.8 | 22.9 | | 11.0 | | | 25.8 | | |
| 1984 | **37.2** | 133.8 | 19.2 | 12.3 | 5.9 | | 1.5 | | | 50.6 | | |
| 1985 | **7.0** | 3.8 | 13.3 | 8.5 | 6.1 | | 1.2 | | | 9.3 | | |
| 1986 | **28.2** | 60.3 | 31.3 | 19.2 | 28.3 | | 19.4 | | | 10.8 | | |
| 1987 | **65.2** | 89.0 | 104.2 | 58.7 | 18.1 | | 11.2 | | | 110.2 | | |
| 1988 | **8.7** | 24.8 | 6.5 | 8.2 | | | 1.2 | | | 3.1 | | |
| 1989 | **6.9** | 26.6 | 0.2 | 2.1 | | | 0.7 | | | 4.8 | | |
| 1990 | **39.9** | 46.3 | 43.9 | 35.5 | | | 50.3 | | | 17.8 | | |
| 1991 | **43.5** | 47.0 | 23.8 | 33.7 | | | 1.2 | | | 117.5 | 37.8 | |
| 1992 | **35.5** | 4.8 | 1.0 | 8.3 | | 76.6 | 0.2 | | | 152.4 | 5.3 | |
| 1993 | **52.3** | 16.2 | 128.1 | 89.8 | | 5.7 | 91.2 | | 15.6 | 71.0 | 0.7 | |
| 1994 | **27.5** | 118.1 | 14.8 | 9.7 | 20.1 | 11.1 | 24.9 | | | 3.7 | 17.6 | |
| 1995 | **41.0** | 42.7 | 7.6 | 10.9 | 10.1 | 17.9 | 66.1 | | 10.4 | 51.0 | 152.1 | |
| 1996 | **115.0** | 75.9 | 157.2 | 206.4 | 87.8 | 190.8 | 123.7 | | 34.9 | 48.2 | 110.3 | |
| 1997 | **17.0** | 11.3 | 1.4 | 8.2 | 6.7 | 38.6 | 16.9 | | 52.7 | 7.2 | 9.7 | |
| 1998 | **17.3** | 55.6 | 38.5 | 27.1 | 11.3 | 1.2 | 3.9 | | 16.1 | 1.1 | 1.4 | |
| 1999 | **39.5** | 25.1 | 9.7 | 13.0 | 15.6 | 3.8 | 112.5 | 43.7 | 21.7 | 52.2 | 98.3 | |
| 2000 | **39.3** | 8.5 | 59.4 | 30.5 | 15.8 | 22.0 | 106.1 | 58.8 | 22.4 | 8.1 | 61.7 | |
| 2001 | **18.3** | 60.3 | 57.4 | 8.8 | 8.4 | 9.8 | 2.3 | 14.2 | 17.6 | 2.9 | 1.0 | |
| 2002 | **17.5** | 4.5 | 2.2 | 3.7 | 7.9 | 2.2 | 6.9 | 63.3 | 12.8 | 40.0 | 31.7 | |
| 2003 | **41.9** | 34.3 | 103.4 | 69.4 | 31.8 | 13.8 | 89.1 | 42.6 | 8.4 | 7.3 | 18.4 | |
| 2004 | **31.6** | 67.8 | 8.4 | 24.9 | 43.6 | 37.9 | 88.9 | 32.8 | 2.4 | 4.5 | 5.0 | |
| 2005 | **39.5** | 28.9 | 44.2 | 23.0 | 57.1 | 36.1 | 117.1 | 26.8 | 21.2 | 37.4 | 3.5 | |
| 2006 | **46.3** | 19.0 | 18.4 | 4.1 | 16.9 | 14.0 | 129.2 | 56.8 | | 49.9 | 108.8 | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | **4.7** | 15.1 | 1.0 | 0.0 | 0.8 | 2.8 | 5.8 | 2.0 | 15.4 | 0.7 | 3.9 | |
| 2008 | **25.1** | 24.3 | 57.1 | 38.6 | 30.2 | 38.4 | 8.6 | 30.6 | 16.2 | 7.0 | 0.4 | |
| 2009 | **41.0** | 58.0 | 40.5 | 31.6 | 14.3 | 6.0 | 65.1 | 20.2 | 81.4 | 55.3 | 38.1 | |
| 2010 | **7.8** | 6.3 | 3.3 | 4.0 | 3.7 | 0.8 | 1.6 | 2.6 | 39.8 | 5.6 | 10.0 | |
| 2011 | **48.1** | 31.3 | 73.2 | 141.2 | 65.1 | 32.8 | 66.2 | 7.0 | 38.1 | 18.4 | 7.6 | |
| 2012 | **4.5** | 5.8 | 7.2 | 1.0 | 0.6 | 1.8 | 2.4 | 12.1 | 2.2 | 8.1 | 3.3 | |
| 2013 | **4.2** | 4.7 | 11.3 | 2.6 | 1.8 | 0.8 | 0.9 | 1.3 | 12.7 | 3.9 | 2.3 | |
| 2014 | **97.8** | 222.8 | 159.8 | 149.0 | 74.9 | 7.0 | 134.4 | 13.6 | 138.5 | 54.1 | 24.1 | |
| 2015 | **12.4** | 17.3 | 18.6 | 16.8 | 2.8 | 21.4 | 6.5 | 14.7 | 32.0 | 1.1 | 4.3 | 1.2 |
| 2016 | **3.4** | 1.5 | 0.5 | 1.0 | 2.6 | 0.6 | 1.5 | 3.8 | 5.9 | 6.9 | 12.5 | 0.4 |
| 2017 | **61.9** | 27.5 | 102.2 | 154.0 | 34.9 | 35.6 | 148.6 | 28.2 | 113.1 | 7.1 | 1.2 | 29.0 |
| 2018 | **7.2** | 19.2 | 5.4 | 9.2 | 0.4 | 0.8 | 1.5 | 13.1 | 3.8 | 13.9 | 12.0 | 0.4 |
| 2019 | **17.2** | 44.4 | 11.0 | 24.0 | 15.1 | 5.8 | 17.5 | 12.2 | 9.0 | 17.5 | 19.6 | 13.0 |
| 2020 | **23.9** | 10.3 | 31.1 | 51.3 | 20.5 | 13.6 | 32.3 | 42.0 | 20.7 | 20.7 | 19.8 | 0.9 |
| 2021 | **18.6** | 23.6 | 9.6 | 11.2 | 0.8 | 0.2 | 55.6 | 6.2 | 5.7 | 40.0 | 49.7 | 2.4 |
| Mean | **27.5** | **35.5** | **29.1** | **26.7** | **15.2** | **20.3** | **30.2** | **23.9** | **28.5** | **29.1** | **22.7** | **6.8** |
| Year | **Southern Region** | LA-Kisatchie National Forest | AL-Escambia Exp. Forest | W FL-Blackwater River State Forest | W FL-Eglin Air Force Base | W FL-Apalachicola National Forest | SW GA-Jones Res. Center | Red Hills-Tall Timbers Res. Station | W GA-Fort Benning Military Base | SC-Sandhills State Forest | NC-Bladen Lakes State Forest | FL Pen.-Ordway-Swisher Biological Station |

Data are the average number of cones per longleaf pine tree forecasted for the fall (late October) with estimates based on counts of green cones during the spring (April and May) of each year.


Longleaf Pine Cone Production in Southern Region (since 1966)
Fair or better cone crops: (≥ 25 cones per tree) = 26 of 56 = 46% of all years
Cones per Tree
Year
Bumper Crop 1
Good Crop 6
Fair Crop 19
Poor Crop 14
Failed Crop 16
0
10
20
30
40
50
60
70
80
90
100
110
120
130
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
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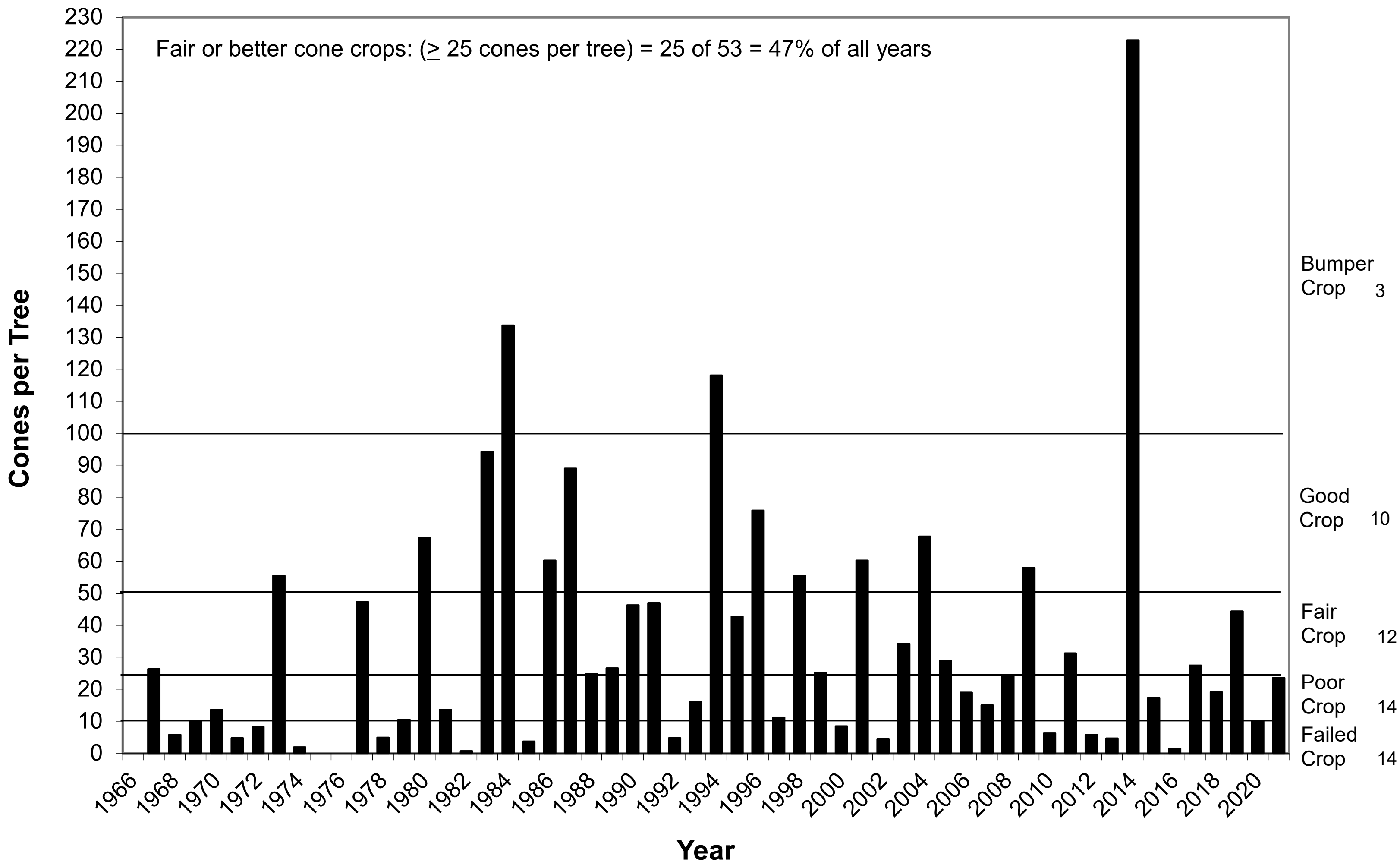
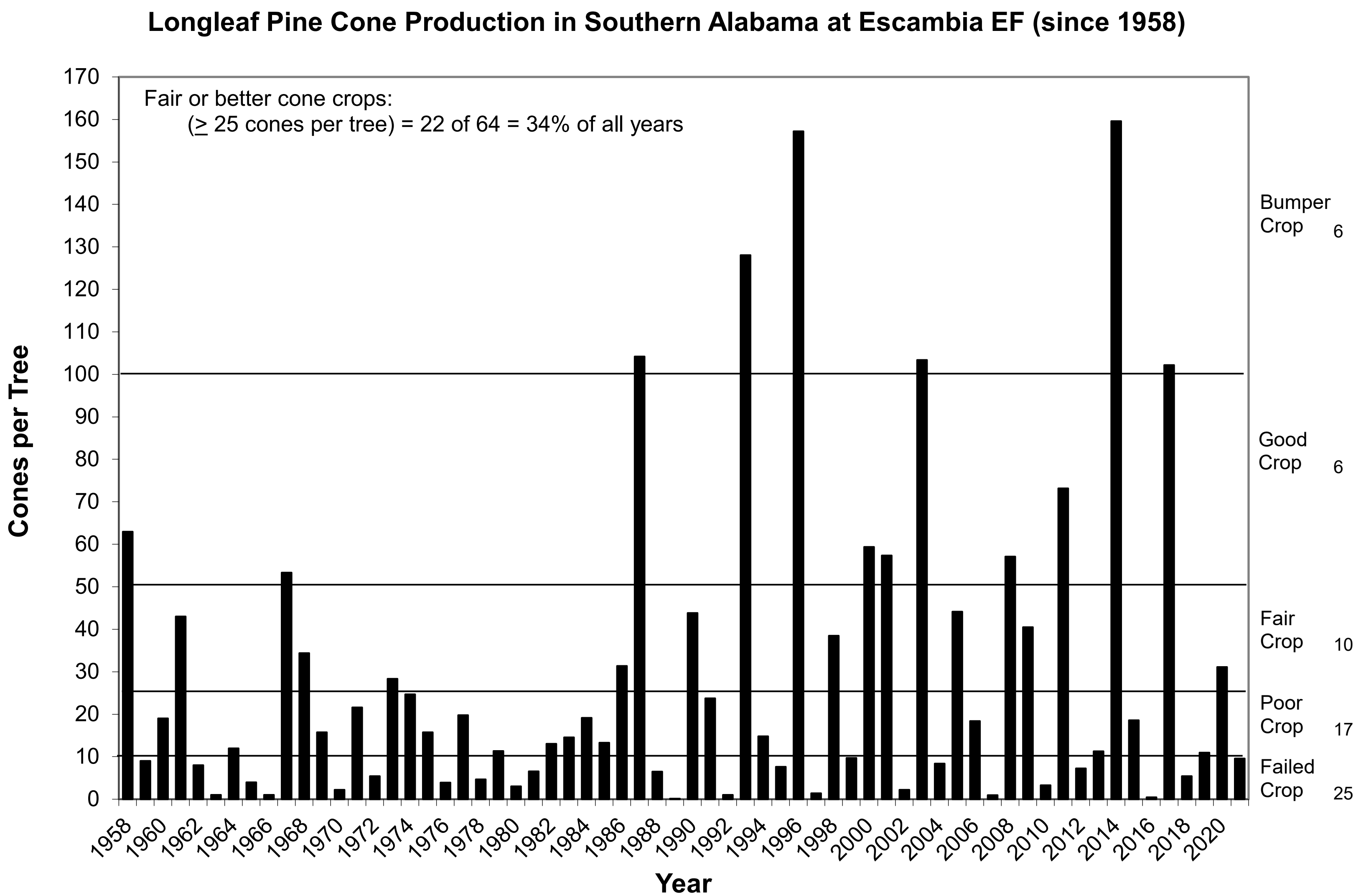
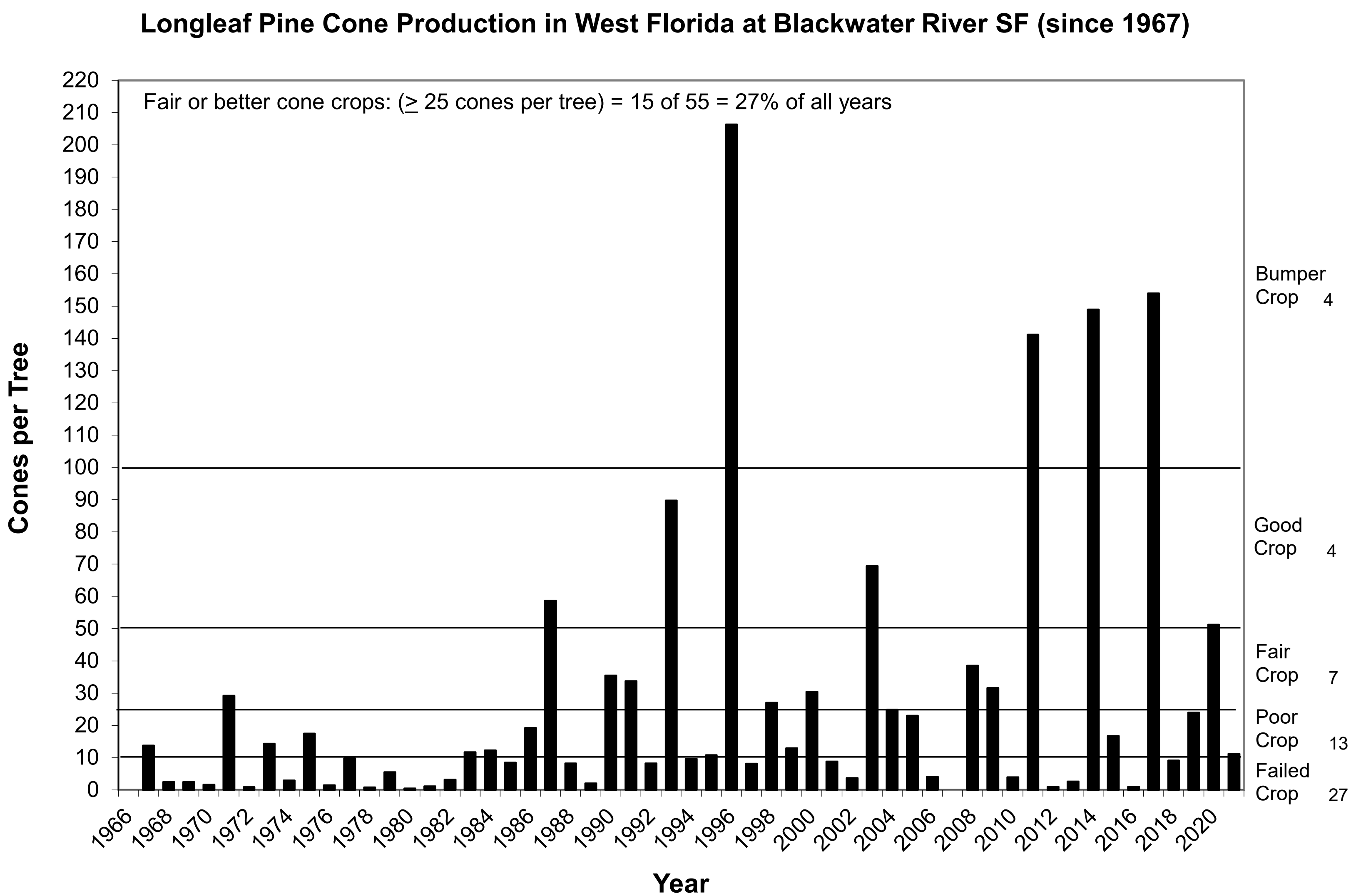
2012
2014
2016
2018
2020

## Longleaf Pine Cone Production in Louisiana at Kisatchie NF (since 1967)

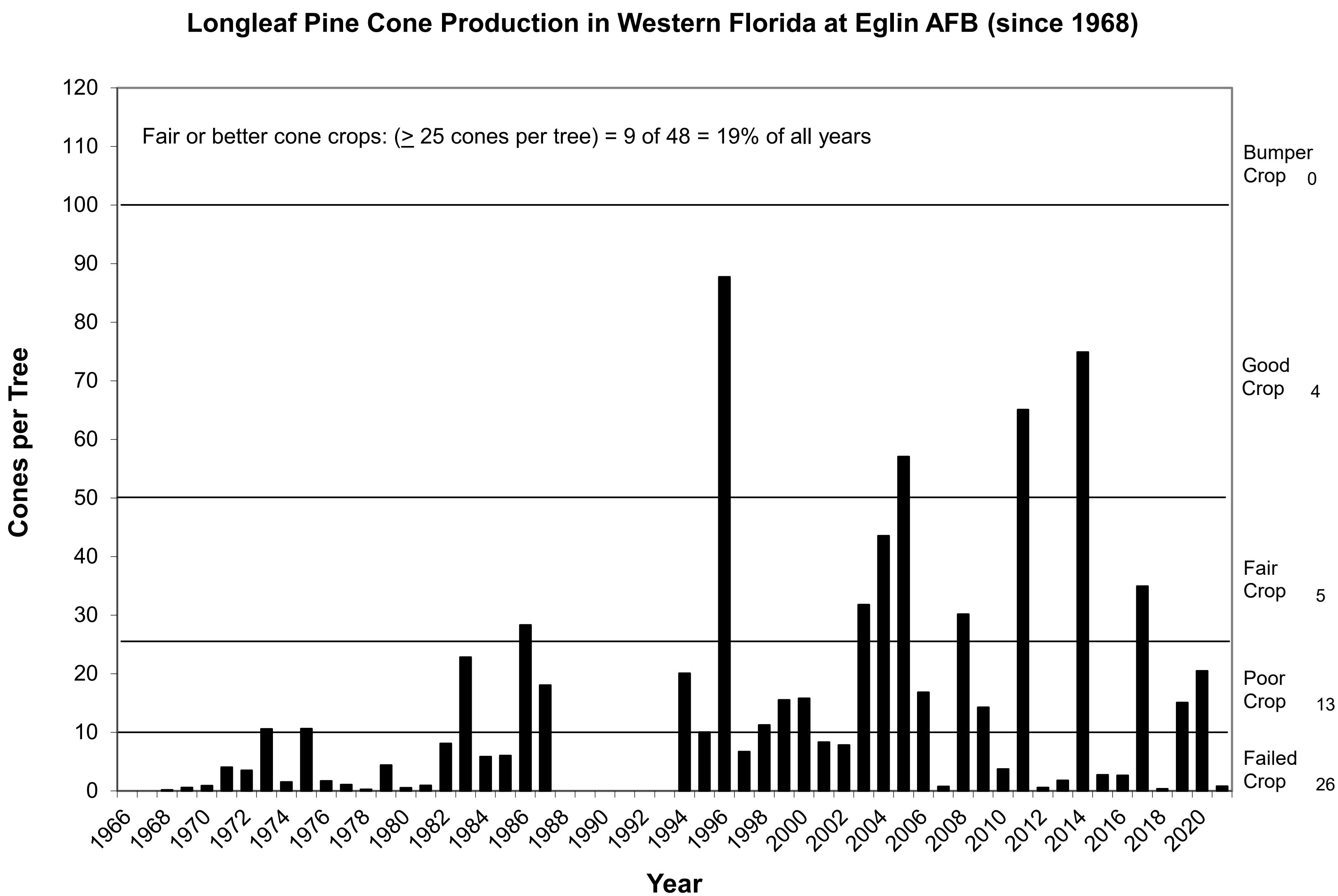




Longleaf Pine Cone Production in Southern Alabama at Escambia EF (since 1958)
Fair or better cone crops:
(≥ 25 cones per tree) = 22 of 64 = 34% of all years
Cones per Tree
Year
Bumper Crop 6
Good Crop 6
Fair Crop 10
Poor Crop 17
Failed Crop 25

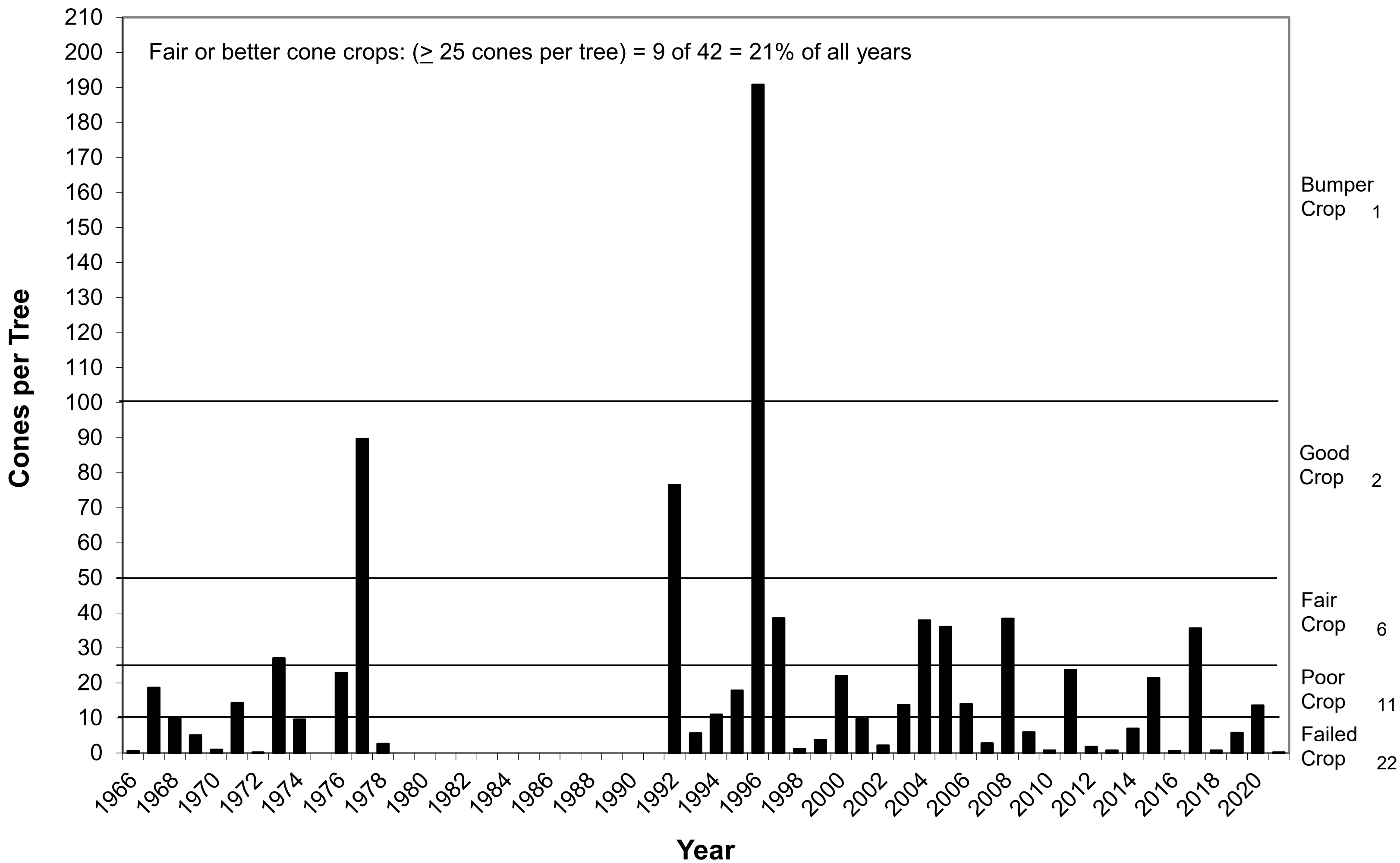


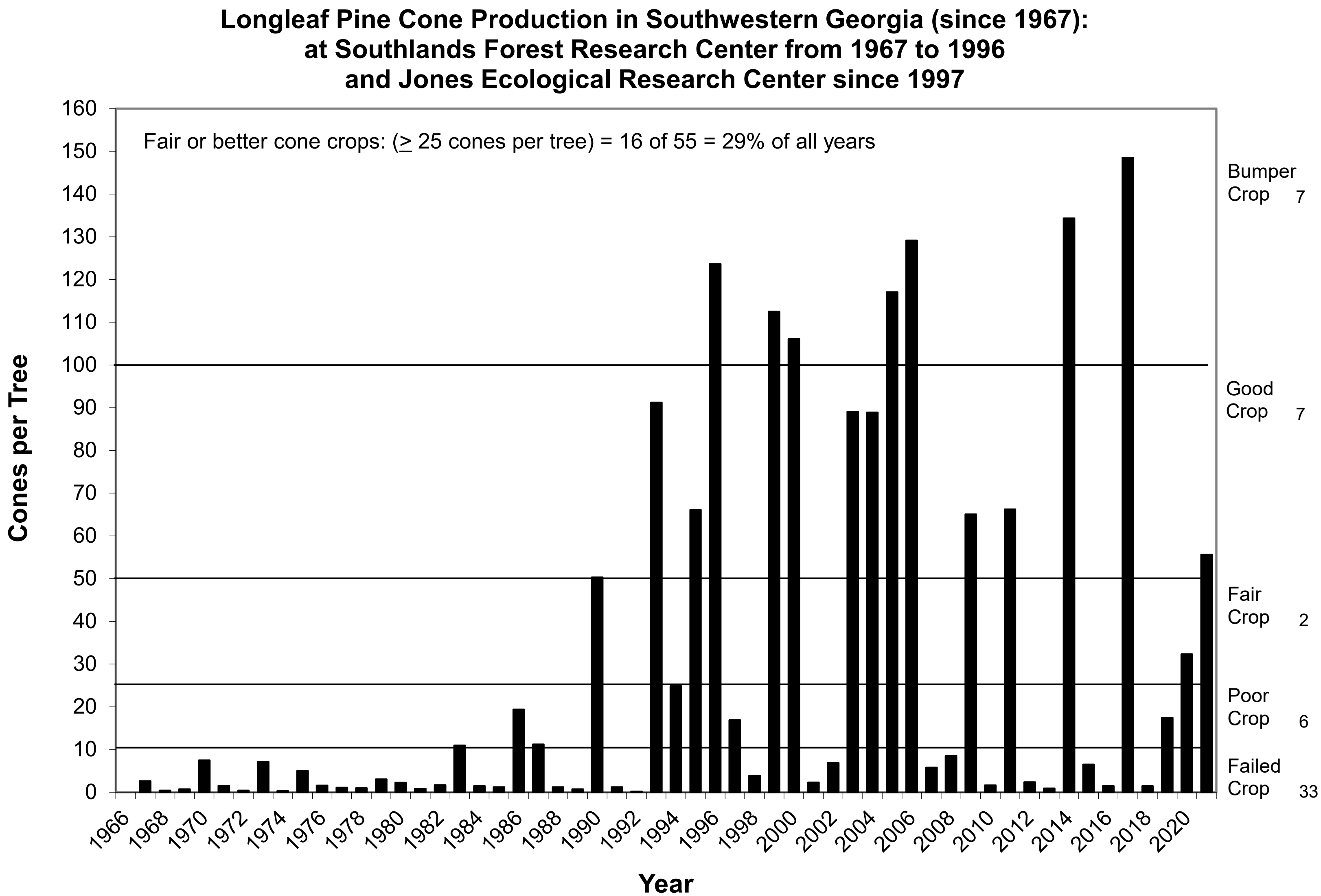
Longleaf Pine Cone Production in West Florida at Blackwater River SF (since 1967)
Fair or better cone crops: (≥ 25 cones per tree) = 15 of 55 = 27% of all years
Cones per Tree
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
Year
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Bumper Crop 4
Good Crop 4
Fair Crop 7
Poor Crop 13
Failed Crop 27



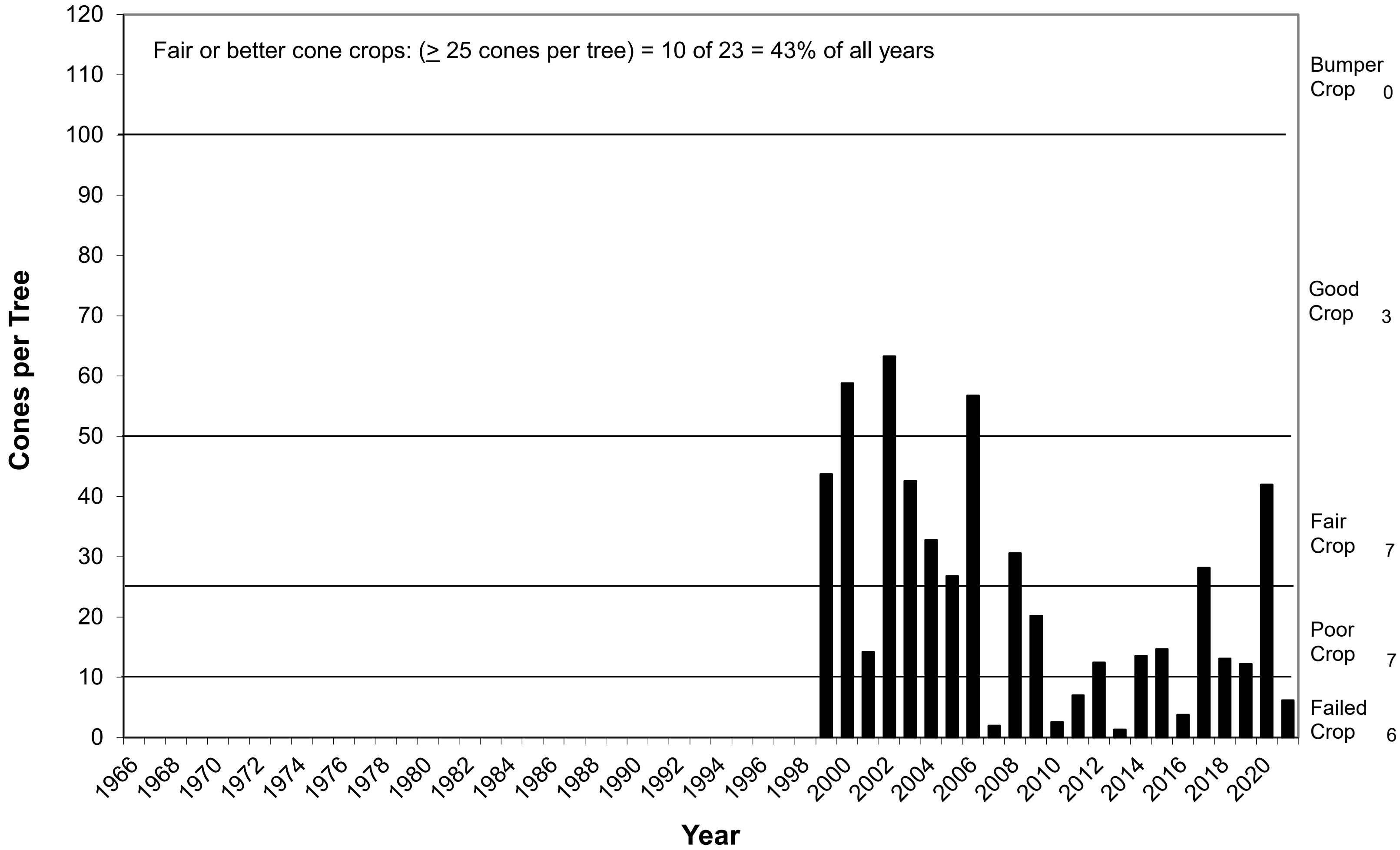
Longleaf Pine Cone Production in Western Florida at Eglin AFB (since 1968)
Fair or better cone crops: (≥ 25 cones per tree) = 9 of 48 = 19% of all years
Cones per Tree
Year
Bumper Crop 0
Good Crop 4
Fair Crop 5
Poor Crop 13
Failed Crop 26

**Longleaf Pine Cone Production in Western Florida at Apalachicola NF (since 1966)**

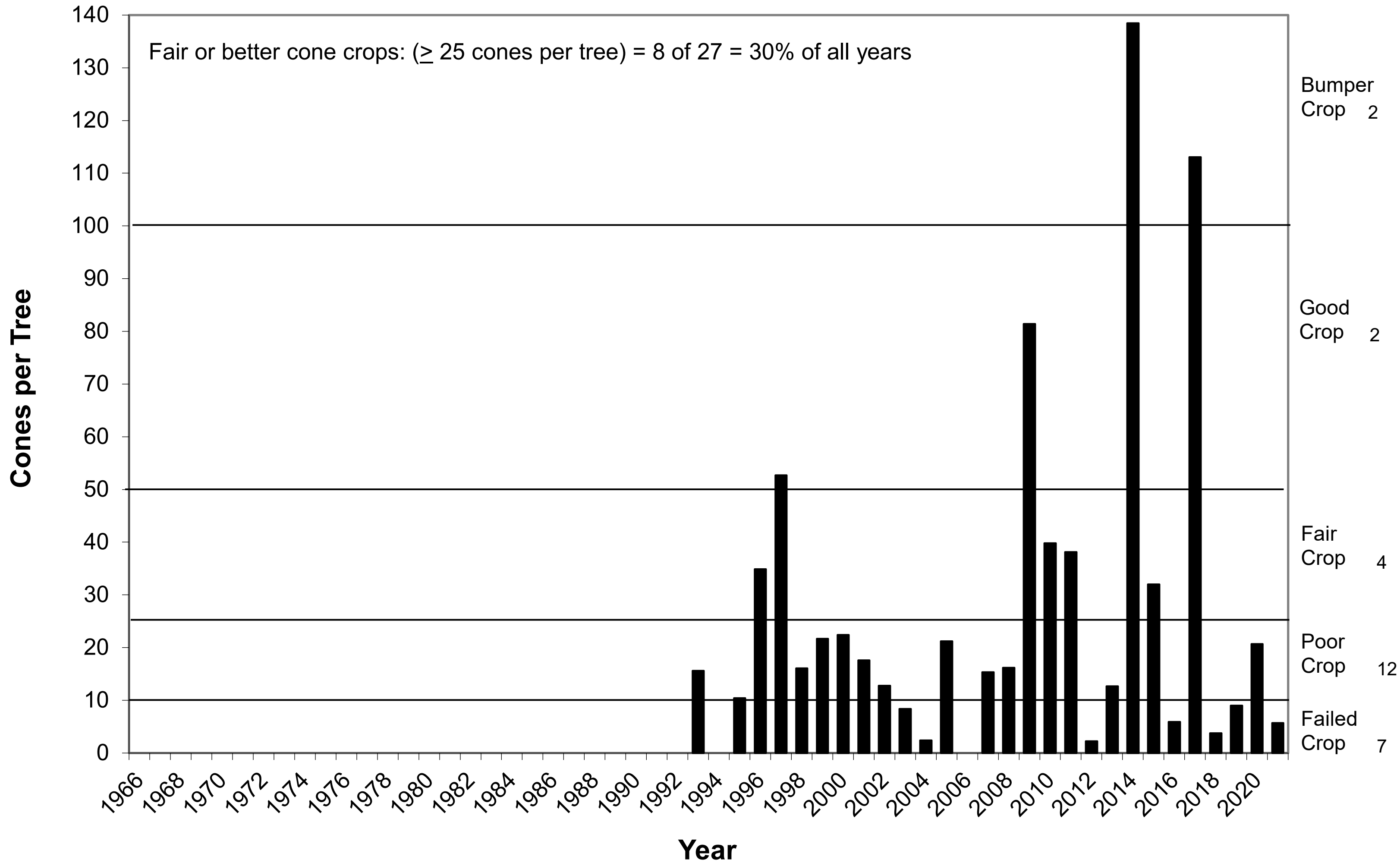


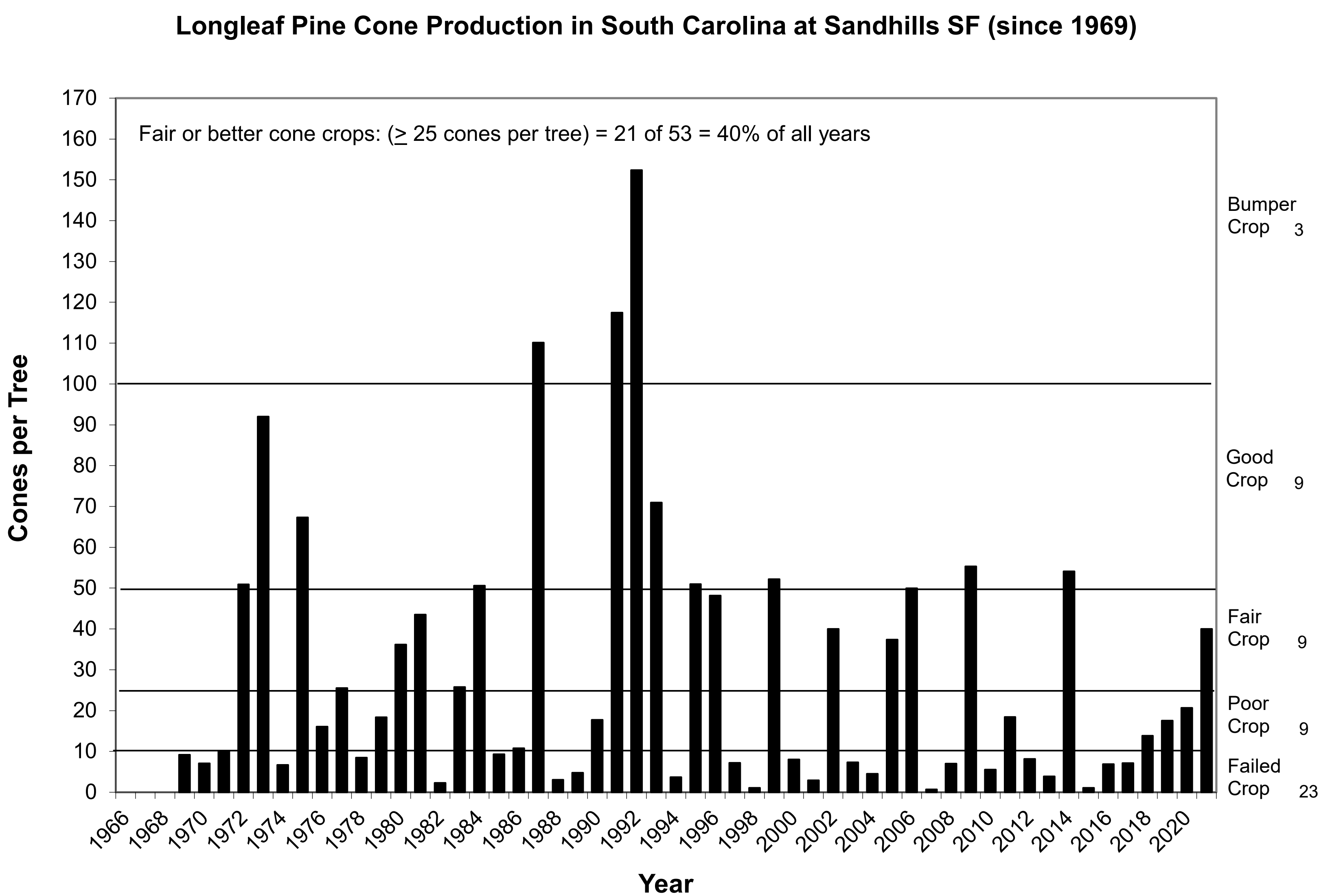

Longleaf Pine Cone Production in Southwestern Georgia (since 1967):
at Southlands Forest Research Center from 1967 to 1996
and Jones Ecological Research Center since 1997
Fair or better cone crops: (≥ 25 cones per tree) = 16 of 55 = 29% of all years
Cones per Tree
Year
Bumper Crop 7
Good Crop 7
Fair Crop 2
Poor Crop 6
Failed Crop 33

**Longleaf Pine Cone Production in the Red Hills (since 1999): at Pebble Hill Plantation from 1999 to 2009 and Tall Timbers Research Station since 2010**

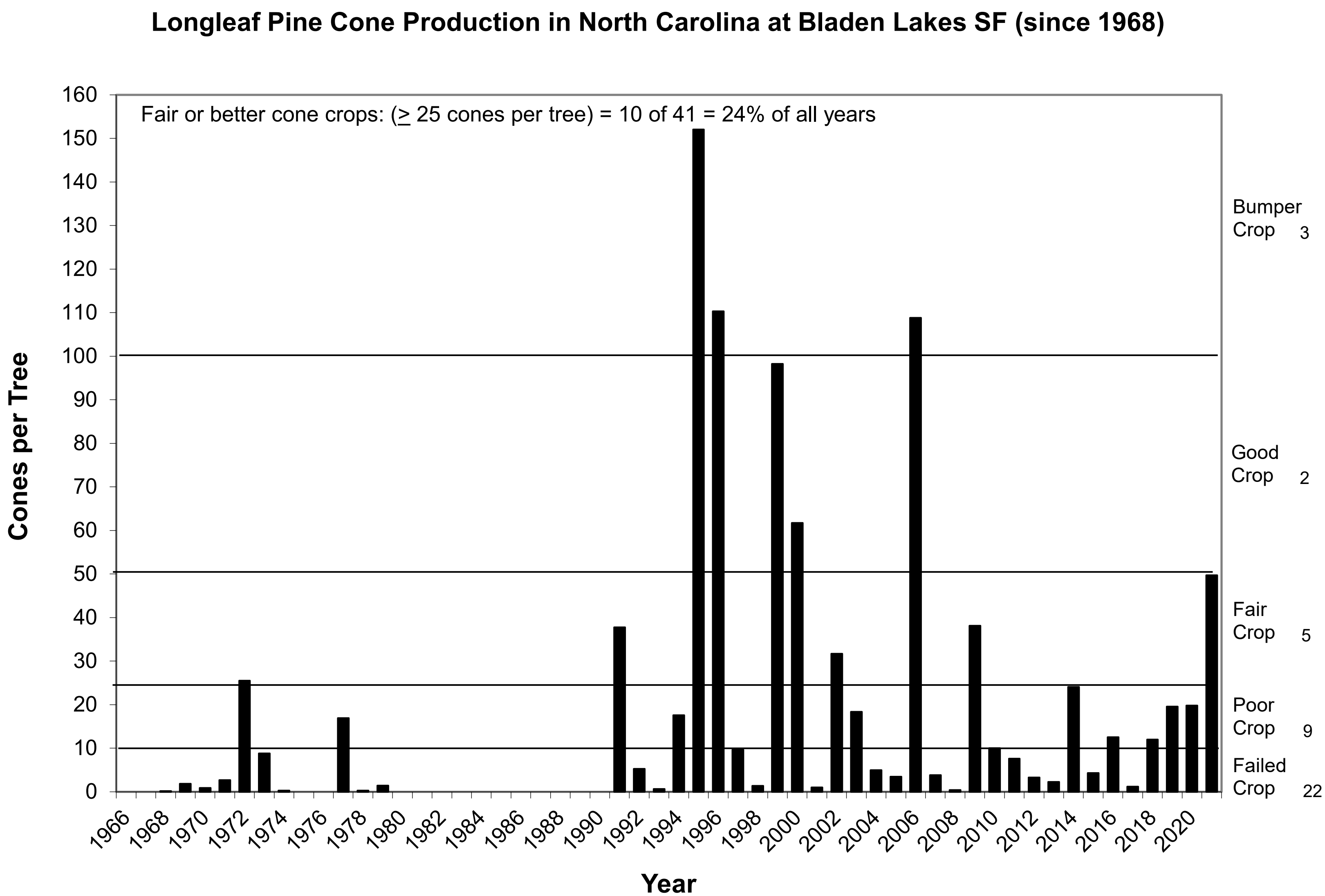


**Longleaf Pine Cone Production in Western Georgia at Fort Benning (since 1993)**





Longleaf Pine Cone Production in South Carolina at Sandhills SF (since 1969)
Fair or better cone crops: (≥ 25 cones per tree) = 21 of 53 = 40% of all years
Cones per Tree
Year
Bumper Crop 3
Good Crop 9
Fair Crop 9
Poor Crop 9
Failed Crop 23


Longleaf Pine Cone Production in North Carolina at Bladen Lakes SF (since 1968)
Fair or better cone crops: (≥ 25 cones per tree) = 10 of 41 = 24% of all years
Cones per Tree
Year
Bumper Crop 3
Good Crop 2
Fair Crop 5
Poor Crop 9
Failed Crop 22
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
1966
1968
1970
1972
1974
1976
1978
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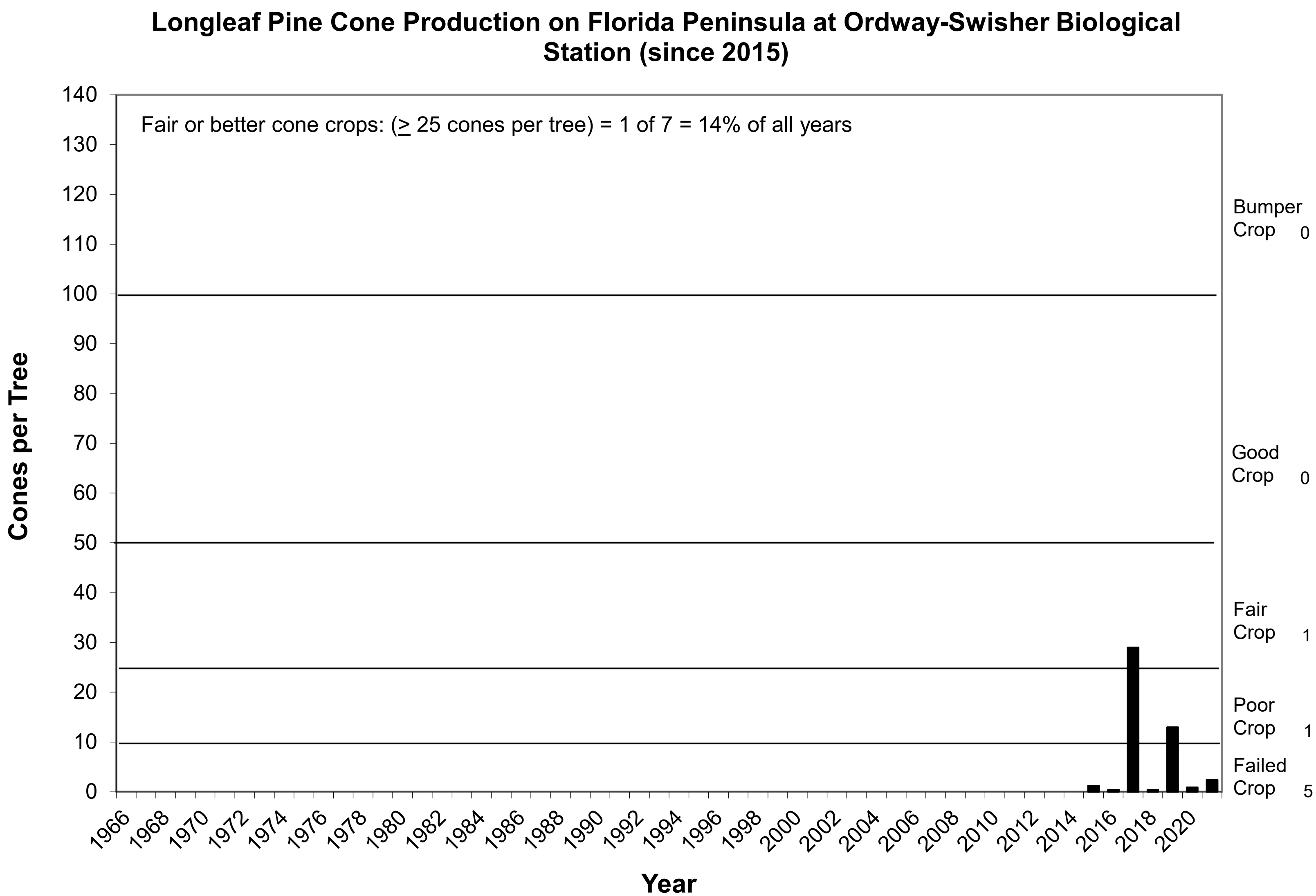
Longleaf Pine Cone Production on Florida Peninsula at Ordway-Swisher Biological Station (since 2015)
Fair or better cone crops: (≥ 25 cones per tree) = 1 of 7 = 14% of all years
Cones per Tree
Year
Bumper Crop 0
Good Crop 0
Fair Crop 1
Poor Crop 1
Failed Crop 5
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
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1996
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2004
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2008
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2016
2018
2020