Letters to the Editor

Source: Natural Areas Journal, 36(3):234-242.
Published By: Natural Areas Association
DOI: http://dx.doi.org/10.3375/043.036.0303
URL: http://www.bioone.org/doi/full/10.3375/043.036.0303

Forum

To the Editor:

A RESPONSE TO HANSON AND ODION

Dear Dr. Menges,

We are writing in reference to the article "Historical Forest Conditions within the Range of the Pacific Fisher and Spotted Owl in the Central and Southern Sierra Nevada, California, USA" by C.T. Hanson and D.C. Odion, which appeared in the January 2016 issue of *Natural Areas Journal*. Our intent is to elucidate two fundamental issues that severely compromise the primary findings of this article.

1. The analyses related to estimating historical vegetation conditions and, thus, inference on historical fire severity rely on extremely coarse spatial scale habitat range maps to identify contemporary conifer forested areas. The following is the pertinent paragraph from the methods section of Hanson and Odion (2016: pg 11):

"To verify that any subsections recorded in 1910/1911 as conifer forests in which high-severity fire occurred actually represented potential conifer forest, we quantified the extent to which any such areas have regenerated back to conifer forest in recent times. For this we used the California Wildlife Habitat Relationships (CWHR) vegetation database (www.dfg.ca.gov/biogeodata/cwhr/) to calculate the proportion of the historical high-severity fire area that is currently vegetated with conifer forest."

The webpage and associated metadata explicitly describe these data, however, as range maps. By definition, range maps only show the potential geographic extent of occurrence, and not actual current existence at specific locations. The following is the dataset description at the above URL provided by Hanson and Odion:
"GIS shapefile datasets captured at 1:1,000,000 scale showing statewide range by season of the 712 terrestrial vertebrates in CWHR and geographic range for the 59 habitat types in CWHR."

The metadata more explicitly describe the data and provide usage limitations:

"The original CWHR habitat range maps were published as images only in "A Guide to Wildlife Habitats of California" (Mayer, K.E. and W.F. Laudenslayer, Jr., editors. 1988. California Department of Forestry and Fire Protection. Sacramento, CA)…. Each original map image was scanned, georectified, and plotted with relevant vegetation and land use data for that habitat type at a scale of 1:1,000,000…. Users will note that ranges represent maximum, current geographic extent for each CWHR habitat type. Although informed by spatially explicit data on vegetation and land use, they are not intended to replace any such mapping effort at any scale in California. Their purpose is to show limits of distribution only. Any given habitat type does not occur evenly throughout its mapped range."

The CWHR range maps indicate that the entire area for which Hanson and Odion (2016) used historical inventory data was potential Sierra Nevada mixed-conifer forest (Figure 1). However, the same maps also indicate that their study area was almost entirely potential montane chaparral (Figure 1). Clearly the scale of these maps do not allow for finer-scale differentiation between conifer and non-conifer vegetation within their study area. Given that Hanson and Odion (2016) relied on the presence of non-conifer vegetation to identify historical area burned by "high severity" fire, there is considerable potential for erroneous conclusions using these maps. Non-conifer vegetation in Sierra Nevada often is a product of strong elevational and edaphic control, completely independent of fire (e.g., low elevation with greater evaporative demand, shallow soils with low water holding capacity). Figure 2[1] shows existing vegetation data circa 2000–2009 as mapped by the USDA Forest Service for the quarter-quarter sections (QQs) in the 1911 survey portion of Hanson and Odion's study. A majority of the QQs that Hanson and Odion identified as non-conifer vegetation in 1911, thus, "evidence" of historical high severity fire, currently remain as non-conifer vegetation. These areas also correspond with lower elevations and much steeper slopes relative to the rest of the QQs in the study area (Figure 3). This suggests factors other than historical high severity fire are controlling the vegetation in these areas, and more concrete evidence is, therefore, required to demonstrate that these areas would have historically been covered with conifer forest.

2. Beyond the problematic assumption of non-conifer forest vegetation being evidence of historical high severity fire, Hanson and Odion (2016) assumed that areas within the greater survey area lacking reported conifer timber volume were also evidence of high-severity fire. This is another false assumption with strong impacts on the interpretations made. The lack of reported timber volume for particular QQs within this survey area was typically associated with areas that were never actually surveyed. This is because there were land patents on many QQs, in part belonging to the White and Friant Lumber Company and Yosemite Lumber Company, thus, were not managed by the US Forest Service. To illustrate this we attached the USDA Inventory Form 322 used by Hanson and Odion[2] for two sections specifically called out in their article[3] (Figure 4). These forms depict the layout of the section divided into QQs. QQs that were not surveyed were noted as patented (handwritten "Pat" in the included examples). The patented QQs in these two sections were all identified as historical high severity fire by Hanson and Odion[4]. What is even more befuddling is how Hanson and Odion claimed that for these sections there were "explicit notes about extensive high-severity fire that were made by the 1911 surveyors."[2] The survey notes

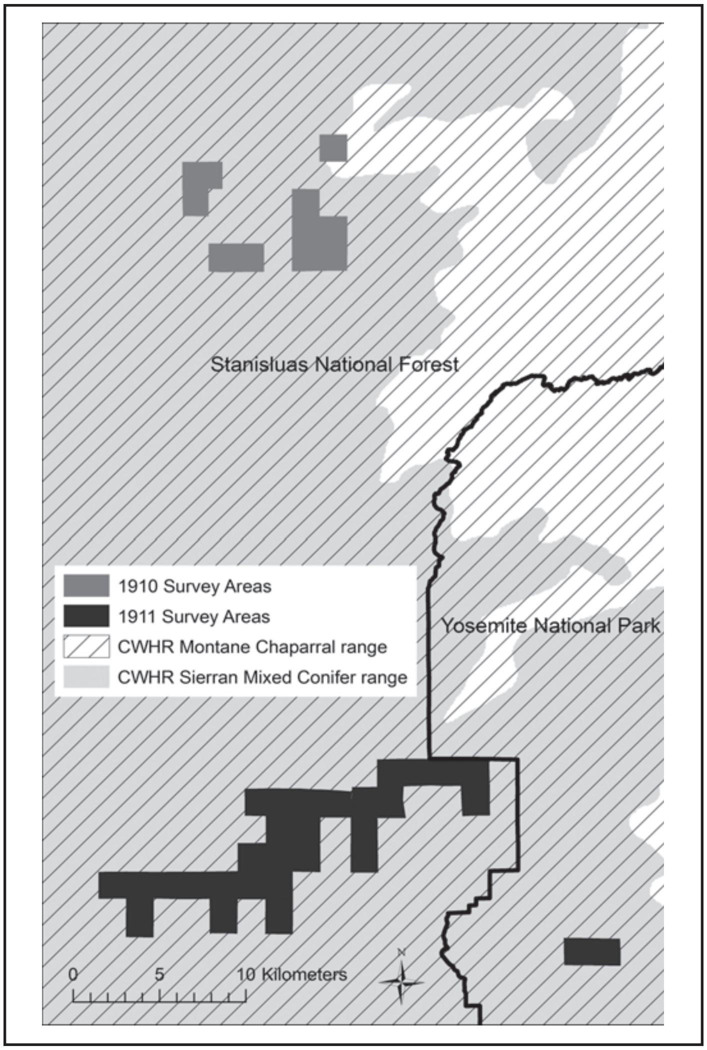


Figure 1. Map corresponding to Hanson and Odion's (2016) study area depicting the coarse spatial scale of the range map. This figure demonstrates that montane chaparral and Sierran mixed conifer CWHR types overlap for almost the entire Hanson and Odion (2016) study area (shaded 1910 and 1911 survey areas).

that accompany the Form 322s for these sections have no such language (Figure 4). Rather, the notes only describe fire scared trees, i.e., what would be typical of low severity effects (Figure 4). We also know that the patented QQs in the provided example were forested in 1930 (and contemporarily represent some of the best examples of old unlogged forests left in the Sierra Nevada) because they were a part of a purchase authorized in the 1930 Federal appropriations bill and funded by J.D. Rockefeller with the expressed intent of preserving "virgin timber" stands (Figure 5). Figure 3 shows additional patented QQs that Hanson and Odion (2016) labeled as "high severity fire" in the portion of their study area that overlapped with a previous study[5].

There is tremendous insight that can be gained by analyzing historical vegetation data. However, failing to fully understand these data and their limitations can lead to erroneous conclusions about the processes driving more natural vegetation dynamics. Both of these issues we described indicate egregious misuse of the CWHR habitat range maps and historical survey data by Hanson and Odion (2016). Hence, the inferences they have drawn from analyses of these data, i.e., historical extent of high severity fire in Sierra Nevada mixed conifer forests, are severely flawed.

Brandon M. Collins
Jay D. Miller
Scott L. Stephens

ENDNOTES:

[1] Available from: <http://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb534719>
[2] Form 322, see Hanson and Odion (2016), p. 15, 3rd column.
[3] Township 2S, Range 20E, Sections 4 and 5; see Hanson and Odion (2016), p 16, 3rd column.
[4] See the two abutted sections in the lower right of Figure 1 in Hanson and Odion (2016).
[5] Collins B.M., J.M. Lydersen, R.G. Everett, D,L. Fry, and S.L. Stephens. 2015. Novel characterization of landscape-level variability in historical vegetation structure. Ecological Applications 25:1167-1174.

NOTE: Supporting figures continued on the following pages

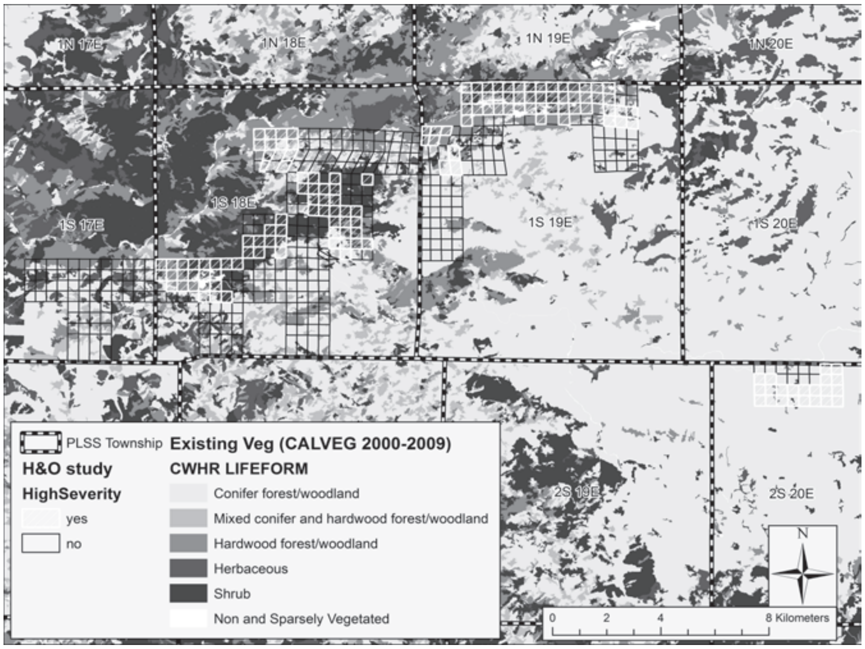


Figure 2. Existing vegetation for the entire 1911 survey area reported by Hanson and Odion (2016). This demonstrates that much of the area considered "high severity" in 1911 by Hanson and Odion (2016) is currently shrub-dominated or mixed-hardwood with strong topographic (elevation, slope, and aspect) and edaphic control, not conifer forest.

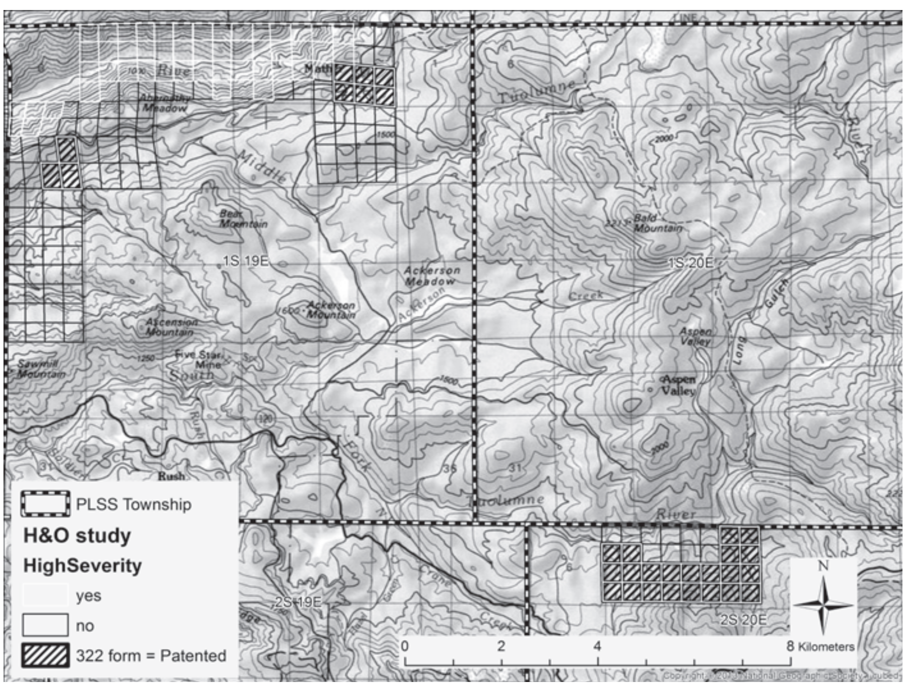
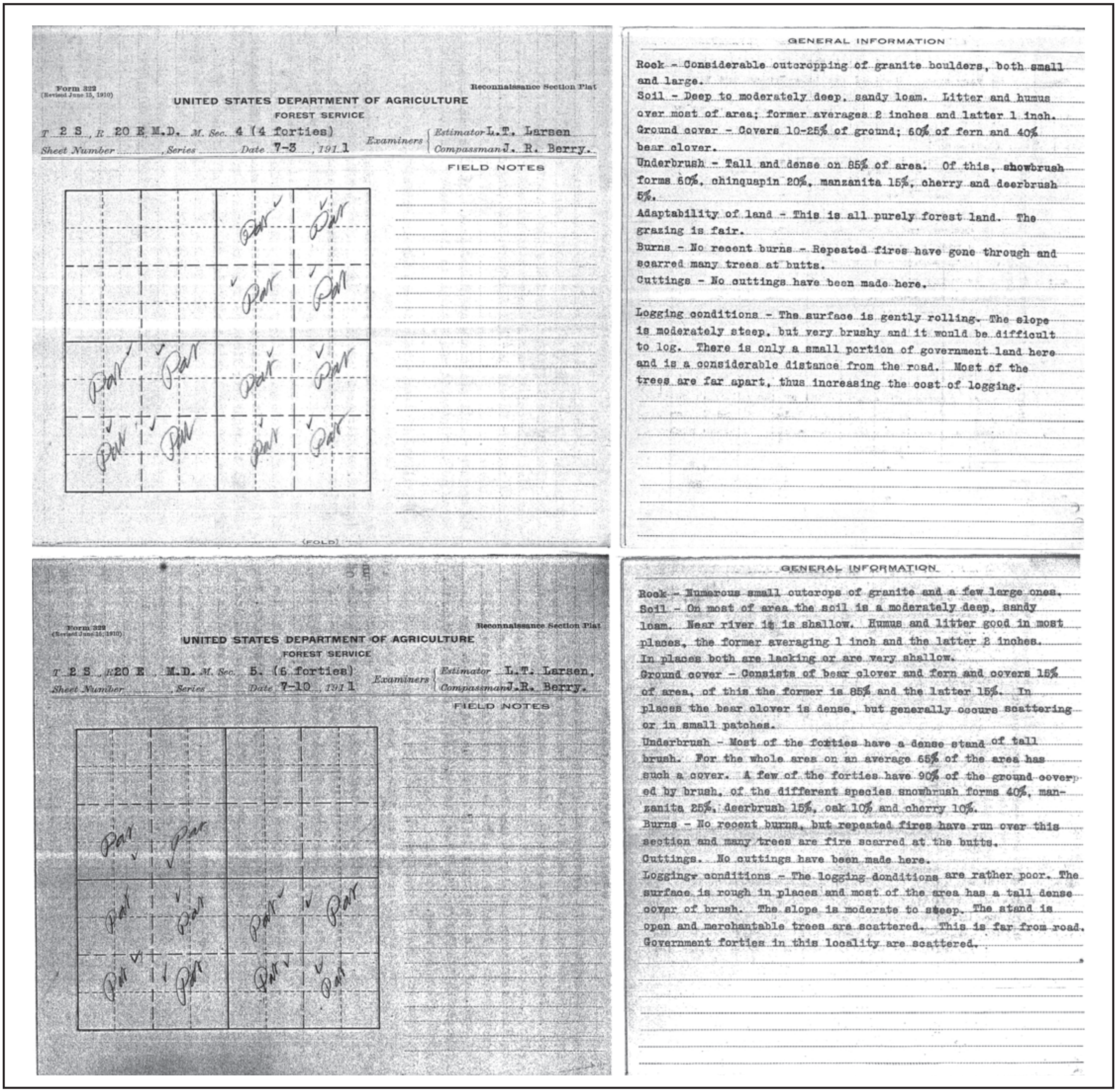


Figure 3. Four townships for which we had the specific 1911 survey forms (Form 322) mentioned by Hanson and Odion (2016). This demonstrates that with the exception of the steep shrub-dominated Tuolumne River Canyon in the northern portion of T1S R19E, much of the area considered "high severity" in 1911 by Hanson and Odion (2016) actually had land patents, hence was not surveyed in 1911.



Form 322
(Revised June 15, 1910)

Reconnaissance Section Plat

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

T 2 S, R 20 E M.D. M. Sec. 4 (4 forties) Examiners { Estimator L.T. Larsen, Compassman J. R. Berry.
Sheet Number ____, Series ____ Date 7-3, 1911

FIELD NOTES

GENERAL INFORMATION

Rock - Considerable outcropping of granite boulders, both small and large.
Soil - Deep to moderately deep, sandy loam. Litter and humus over most of area; former averages 2 inches and latter 1 inch.
Ground cover - Covers 10-25% of ground; 60% of fern and 40% bear clover.
Underbrush - Tall and dense on 85% of area. Of this, snowbrush forms 60%, chinquapin 20%, manzanita 15%, cherry and deerbrush 5%.
Adaptability of land - This is all purely forest land. The grazing is fair.
Burns - No recent burns - Repeated fires have gone through and scarred many trees at butts.
Cuttings - No cuttings have been made here.

Logging conditions - The surface is gently rolling. The slope is moderately steep, but very brushy and it would be difficult to log. There is only a small portion of government land here and is a considerable distance from the road. Most of the trees are far apart, thus increasing the cost of logging.

Form 322
(Revised June 15, 1910)

Reconnaissance Section Plat

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

T 2 S, R 20 E M.D. M. Sec. 5. (6 forties) Examiners { Estimator L.T. Larsen, Compassman J.R. Berry.
Sheet Number ____, Series ____ Date 7-10, 1911

FIELD NOTES

GENERAL INFORMATION

Rock - Numerous small outcrops of granite and a few large ones.
Soil - On most of area the soil is a moderately deep, sandy loam. Near river it is shallow. Humus and litter good in most places, the former averaging 1 inch and the latter 2 inches. In places both are lacking or are very shallow.
Ground cover - Consists of bear clover and fern and covers 15% of area, of this the former is 85% and the latter 15%. In places the bear clover is dense, but generally occurs scattering or in small patches.
Underbrush - Most of the forties have a dense stand of tall brush. For the whole area on an average 65% of the area has such a cover. A few of the forties have 90% of the ground covered by brush, of the different species snowbrush forms 40%, manzanita 25%, deerbrush 15%, oak 10% and cherry 10%.
Burns - No recent burns, but repeated fires have run over this section and many trees are fire scarred at the butts.
Cuttings. No cuttings have been made here.
Logging conditions - The logging donditions are rather poor. The surface is rough in places and most of the area has a tall dense cover of brush. The slope is moderate to steep. The stand is open and merchantable trees are scattered. This is far from road. Government forties in this locality are scattered.

Figure 4. USDA Survey Form 322 and survey's notes, which mention fire effects for the two sections (sections 4 and 5 of T2S 20E) included in Hanson and Odion (2016). "Pat" is written for several quarter-quarter sections ("forties") indicating that these areas were patented at the time of the survey. These two sections are shown in Figure 3 (bottom right).

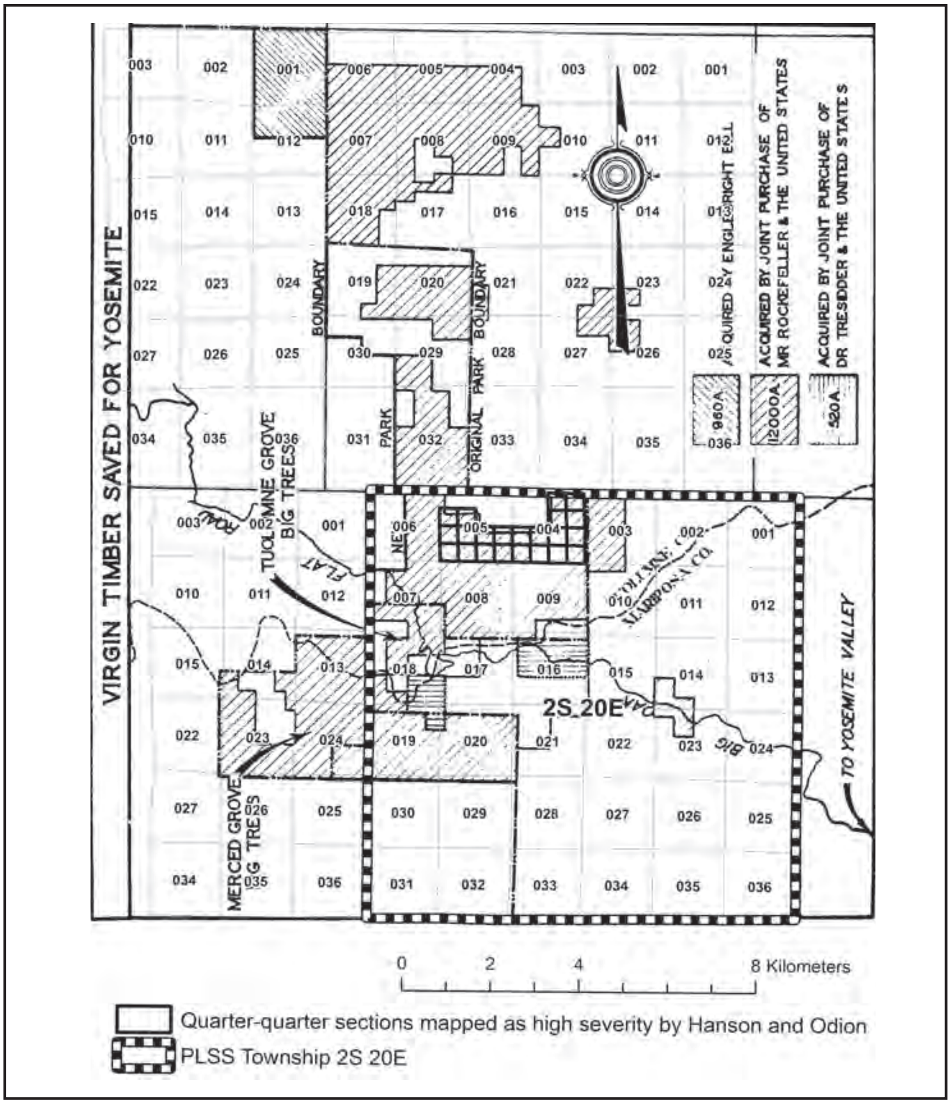


Figure 5. Quarter-quarter sections in T2S 20E, sections 4 and 5 mapped as high severity fire by Hanson and Odion (2016) that were part of an authorization to purchase private lands in the 1930 Federal appropriations bill to be funded by J.D. Rockefeller with the expressed explicit intent of preserving "virgin timber" stands. Underlying map of Rockefeller funded purchase can be found online at: <http://www.yosemite.ca.us/library/yosemite_resources/mather_years.html#page_682>.

Forum

A RESPONSE TO COLLINS, MILLER, AND STEPHENS

Dear Dr. Menges,

We are writing in reply to Collins et al.'s comment (this issue) on Hanson and Odion (2016), "Historical Forest Conditions within the Range of the Pacific Fisher and Spotted Owl in the Central and Southern Sierra Nevada, California, USA" (January 2016 issue of NAJ). Our paper, as well as previous work by Collins et al., use the same 1910/1911 data set (hereafter the timber survey) from the same forests, but reach different conclusions. The differences are due largely to the way that data were selected from the surveys. This illustrates how data selection can be a critical consideration in historical reconstructions.

Collins et al. present a contemporary map showing areas where current vegetation is mostly oak and shrubs, implying that these areas should have been excluded from our analysis. This reflects a lack of understanding regarding the events that led to a preponderance of shrub and oak areas currently, in much of the conifer forest areas that experienced high-severity fire prior to the 1911 surveys. Specifically, large, intense fires occurred in 1987, 1996, and 1999, that were followed by post-fire clearcutting. Areas affected by this have mostly bare ground with some shrub and grass cover (See, e.g., Figure 1a-b).

The map presented by Collins et al. post-dates most of the logging, so it includes areas that had been forest, but were converted to shrub and oak vegetation. To determine the potential effects of excluding the area that Collins et al. believe should not have been included, we assessed the vegetation in these areas as of 1992, prior to most of the clearcut logging described above.[1] We used the U.S. Geological Survey's "1992 National Land Cover Dataset" (1992 NLCD), which has a resolution of 30 meters (30-meter by 30-meter pixels).[2]

These data reveal that, by 1992, 68% of the historical high-severity fire areas that we reported in Hanson and Odion (2016), based on 1911 U.S. Forest Service field notes, consisted of conifer forest ("evergreen forest"), defined as having >75% conifer cover (see URLs endnote 1), and an additional 13% consisted of mixed-conifer/oak ("mixed forest"), defined as having 25–75% conifer cover (Figure 2). Only 19% consisted of shrub and oak habitat, but this, too, may be consistent with natural succession variability a century or so after high-severity fire in less productive habitats.[3] Thus, excluding the areas Collins et al. believe should be excluded would lead to a large underestimate of actual levels of historical high-severity fire described in surveys.

The other concern that Collins et al. had was that some of the surveys were on "patented" lands that were not managed as government lands when the U.S. Forest Service field surveys occurred in 1911 and, hence, were unsurveyed. We were not aware of this, and we appreciate Collins et al. bringing it to our attention, but it only has a minor effect on our results. Of the 646 subsections (16.2 ha in size each) that we analyzed in Hanson and Odion (2016), 31 of these, or 5% of the total, were on "patented" lands.

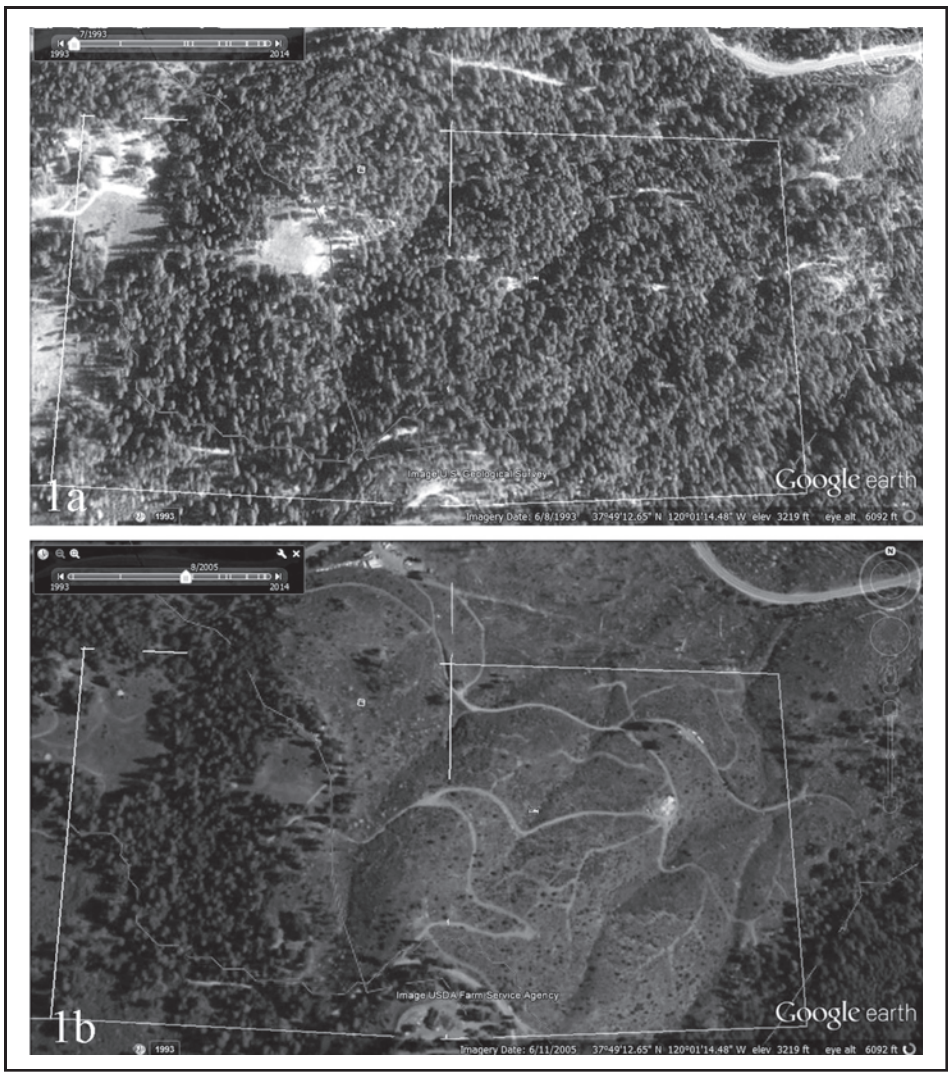


Figure 1a-b. The southeastern portion of Map Section 29, T. 1 S., R. 18 E., showing (a) conifer forest in 1993, prior to the 1999 Pilot fire, and (b) largely bare ground with scattered shrubs in 2005, after post-fire clearcut logging.

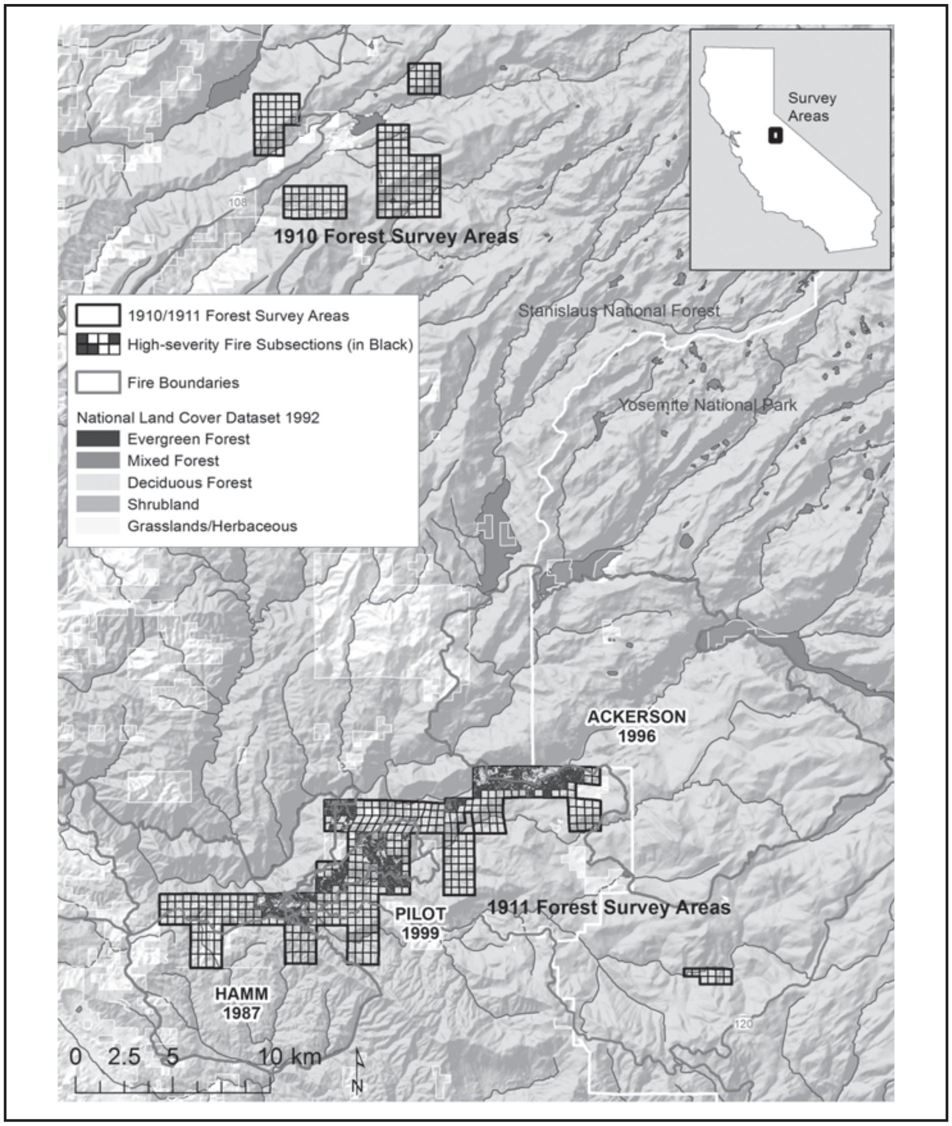


Figure 2. Vegetation cover, in 1992, of the high-severity fire areas from the 1911 surveys, with 1987, 1996, and 1999 fires shown (and patented lands deleted from the study area).

Correcting this error, average high-severity fire proportion in the main portion of our study area—the 1911 portion—changed from 37% to 31%; and, in the entire study area (1910 and 1911 portions combined), historical high-severity fire proportion changed from 26% to 22%. After the adjustment for the 5% of subsections that were on patented lands, there was still no significant difference in historical high-severity fire proportion between ponderosa pine, mixed-conifer/pine, and mixed-conifer/fir forest types ($\chi^2 = 1.58$, $p = 0.454$, df = 2, n = 379 plots). Also, after dropping the patented subsections, the historical high-severity fire rotation interval in these forests changed from 231 years to 273 years.

Collins et al. said they are "befuddled" about the existence of 1911 U.S. Forest Service field survey notes regarding high-severity fire. But those notes exist. The 1911 field notes (Form 322's) are straightforward and direct in describing high-severity fire occurrence in areas that were forested at the time of these fires (see Table 1 for relevant excerpted quotes and locations on U.S. Forest Service (non-patented) lands, and Appendix A (Appendices posted online: <http://johnmuirproject.org/scientific-research/> or Refer to BioOne to view the appendices) for scanned copies of the field notes describing high-severity fire areas).[4]

Overlooking these notes omits key information on the disturbance dynamics of the study area forests and may be another reason that Collins et al.'s results differed from ours.

A substantial occurrence of historical high-severity fire may seem somewhat unlikely, given previous studies reporting open, low-density forests in historical ponderosa pine and mixed-conifer types (Collins et al. 2011, Collins et al. 2015, Harris and Taylor 2015).[5] However, percent cover of shrubs was high in the majority of these forests (Collins et al. 2015; Table 1), as was the density of regenerating conifer seedlings/saplings (Hanson and Odion 2016),

Table 1. Quotes from 1911 field survey notes, Form 322s, regarding high-severity fire in conifer forests ("forties" refers to the 16.2-ha subsections).

Quotes from 1911 field survey notes
T1S, R18E, Sec. 9: "There is timber only on four forties of this section. The rest of the section has a very dense stand of brush…There are several large dense sapling stands….Severe fire went through here years ago and killed most of the trees and land was reverted to brush."
T1S, R18E, Sec. 14: "Only nine forties have any timber at all…Fires have killed most of timber and most of section has reverted to brush."
T1S, R18E, Sec. 15: "Only 7 forties in this section have any timber…Former fires killed most of the timber on this section and land has reverted to brush."
T1S, R18E, Sec. 21: "Only 6 forties have merchantable timber…Old fires killed most of timber on this section and most of area is now brushland."
T1S, R18E, Sec. 23: "Only 5 forties of this section are timbered…Most of timber on section has been killed by fires which occurred many years ago."
T1S, R18E, Sec. 29: "Only find timber on 5 forties of this section…Old fires killed most of trees and most of section is now brushland."
T1S, R18E, Sec. 30: "Only five forties in this section have merchantable timber…Old fires killed the timber and most of land has become brushland."
T1S, R19E, Sec. 3: "Only three forties in this section contain merchantable timber…Repeated fires have killed most of the timber and most of the area is now brushland."
T1S, R19E, Sec. 4: "Only three forties of this section…contain timber…There is a very dense cover of brush on 90-100% of the area on the entire section, except on the three forties which are timbered…Repeated fires have killed much of the timber in this section."
T1S, R19E, Sec. 5: "Only three forties…contain merchantable timber…The brush is dense on the entire section…Repeated fires have changed most of the section to brushland."
T1S, R19E, Sec. 7: "Only 8 forties of this section contain merchantable timber. The rest of the section is brushland…Repeated fires years ago have killed much of the timber."

inconsistent with frequent, low-severity fire maintaining sparse understory vegetation. And, dendroecological reconstructions, using current stand structure and conditions to infer forest structure a century or more ago (Harris and Taylor 2015), are unreliable because they cannot determine the extent to which understory, or overstory, trees that existed in the 1800s may have long ago died (from drought/beetles, fire, or age) or fallen and decayed into soil, leaving no trace, which virtually guarantees an underestimation of historical forest density. Moreover, some previous work likely substantially underestimated historical density of conifers and historical canopy cover due to the fact that the 1911 surveyors on the Stanislaus National Forest used transects two chains wide (40.2-m wide) (Collins et al. 2011), and U.S. Forest Service correspondence in the early 20th century regarding these surveys reveals that: (a) surveyors did not actually measure the transect width, but instead visually estimated distance; (b) transects two chains in width were found to be too wide, leading surveyors to effectively apply, in the field, a much narrower transect than intended, omitting many of the trees that should have been included in a two-chain-wide transect; and (c) surveyors had a tendency to focus overly on noticing and including large trees, while tending to omit smaller trees, leading to a skewed representation of the density of large trees relative to smaller ones (Appendix B) (Appendices posted online: <http://johnmuirproject.org/scientific-research/> or Refer to BioOne to view the appendices).

In summary, concern by Collins et al. about vegetation mapping was based on a misunderstanding. Collins et al. identified areas that they believe were not historically forested, and which they believe we should not have included in our analysis. Had we excluded these areas, we would have omitted significant amounts of historical high-severity fire in forests, and mistakenly concluded that the landscape was much less dynamic than it was. This would have been more consistent with their analysis, which did omit significant amounts of high-severity fire through exclusion of data and descriptions. We did mistakenly include in our analysis a small area (5% of the study area) that was unsurveyed (although it did contain notes on fire). Thus, our data analysis to capture high-severity fire is characterized by a small error of commission (which we corrected) and no error of omission[6], while the approach advocated by Collins et al. is characterized by a large error of omission. We agree with Collins et al. that "failing to fully understand these data and their limitations can lead to erroneous conclusions about the processes driving more natural vegetation dynamics…". Omission of data and descriptions is an approach that leads to erroneous conclusions, and one that we avoided.

Chad T. Hanson
Dennis C. Odion

ENDNOTES:

[1] Geographical Information Systems (GIS) data for this dataset accessed at: http://www.mrlc.gov/nlcd92_data.php, and viewer/downloader at: http://www.mrlc.gov/viewerjs/.
[2] Geographical Information Systems (GIS) data for this dataset accessed at: http://www.mrlc.gov/nlcd92_data.php>, and viewer/downloader at: http://www.mrlc.gov/viewerjs/.

[3] See, e.g.: Nagel, T.A., and A.H. Taylor. 2005. Fire and persistence of montane chaparral in mixed conifer forest landscapes in the northern Sierra Nevada, Lake Tahoe Basin, California, USA. Journal of the Torrey Botanical Society 132: 442-457.

[4] Collins et al. question why we identified two particular 259.1-ha sections as having had high-severity fire, and they state that the field notes for these two sections "only describe fire scarred trees, i.e., what would be typical of low severity effects". On the contrary, the notes describe more than this. The field notes describe a low density of large, surviving trees, located "far apart" and note significant fire scarring on the remaining live trees. The surveyors also noted that there was "too much brush" to access these areas for future logging, describing "Tall and dense" montane chaparral "on 85%" of one section, and "a dense stand of tall brush" averaging 65% cover, but as high as 90%, in the other section (see Figure 4 of Collins et al.). In both cases *Ceanothus velutinus*, a native shrub strongly associated with high-severity fire (its recruitment occurs following such fire), and which can reach 4 m in height, was dominant (Figure 4 of Collins et al.). Such high levels of shrub cover are not consistent with low-severity fire (e.g.: Collins, B.M., and G.B. Roller. 2013. Early forest dynamics in stand-replacing fire patches in the northern Sierra Nevada, California, USA. Landscape Ecology DOI: 10.1007/s10980-013-9923-8). Although there is evidence consistent with high-severity fire in these two sections, Collins et al. are correct that we should not have included them in the high-severity total because, due to the patented lands issue, we did not have survey data as we did for the other sections.

[5] See: (a) Collins, B.M., R.G. Everett, and S.L. Stephens. 2011. Impacts of re exclusion and recent managed re on forest structure in old growth Sierra Nevada mixed-conifer forests. Ecosphere 2: Article 51; (b) Collins, B.M., J.M. Lydersen, R.G. Everett, D.L. Fry, and S.L. Stephens. 2015. Novel characterization of landscape-level variability in historical vegetation structure. Ecological Applications 25:1167-1174; and (c) Harris, L., and A.H. Taylor. 2015. Topography, fuels, and re exclusion drive re severity of the Rim Fire in an old-growth mixed-conifer forest, Yosemite National Park, USA. Eco-systems doi:10.1007/s10021-015-9890-9.

[6] We note that we only analyzed a portion of high-severity fire effects in Hanson and Odion (2016)—areas of 100% tree mortality; thus, our results are conservative.

Appendices <http://johnmuirproject.org/scientific-research/> and (Refer to BioOne to view the appendices)