SYMPOSIUM ARTICLES

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Fighting Fire with Fire? Adjusting Regulatory Regimes and Forest Product Markets to Mitigate Southern United States Wildfire Risk

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INTRODUCTION

The southern United States is a very wet place.[1] While the South has historically dealt with natural fire cycles and has suffered periodic calamitous wildfires impacting its forests, it has not historically been the poster child for raging wildfires. That mantle belongs to the western United States. Because the South is wet, large fires can be avoid-

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1 *See* NAT'L OCEANIC & ATMOSPHERIC ADMIN., *Precipitation Analysis Climatology (1981-2010)*, https://www.climate.gov/sites/default/files/CPC%20Monitoring.png (last visited Mar. 13, 2018) (noting that some areas in the South average over 400 mm of precipitation from December 1st to February 28th).

ed/mitigated through controlled burns that remove fuel from the forest floor without the risk of runaway wildfire like we see in the much drier West. But the southeastern advantage of wetness is changing. Climate change is expected to make the South warmer and increase the length and frequency of drought conditions, setting the stage for increased wildfire activity. How can the South better manage its forests for wildfire prevention and mitigation during a time of climate change? This Article introduces some of the legal and political issues that make doing so a particular challenge for the southeastern United States—where 86% of the forests are privately owned[2]—and will suggest some potential avenues to improve southern wildfire management.

Part I details the risks that climate change poses to southern forests, particularly relating to wildfire risk. Part II raises some of the challenges unique to the South that make addressing increased wildfire risk difficult. Part III discusses some approaches that southern state policy-makers should consider to address wildfire risk exacerbated by climate change. These include not only regulatory measures but also the facilitation of forest product markets that could assist in reducing fuel buildup on the forest floor and thus reduce the risk of catastrophic fire.

I
CLIMATE RELATED RISKS TO SOUTHERN FORESTS

Contrary to conventional wisdom, the southeastern United States actually leads the nation in the number of wildfires per year.[3] The region averaged approximately 45,000 fires per year at the turn of the twenty-first century.[4] In addition, "a disproportionate number of the structures destroyed nationally by wildfires are located in the Southeast."[5] The southeastern U.S. wildfires of 2016 foreshadow what may be on the horizon for the southern forest landscape. The most prominent of those fires was the Chimney Top fire that destroyed much of the resort towns of Gatlinburg and Pigeon Forge, Tennessee, causing

2 DAVID N. WEAR & JOHN G. GREIS, U.S. DEP'T OF AGRIC., THE SOUTHERN FOREST FUTURES PROJECT: TECHNICAL REPORT 103 (2013).

3 Robert J. Mitchell et al., *Future Climate and Fire Interactions in the Southeastern Region of the United States*, 327 FOREST ECOLOGY & MGMT. 316, 317 (2014).

4 WEAR & GREIS, *supra* note 2, at 509.

5 *Id.* at 510.

tens of thousands of people to evacuate.[6] The fires burned 17,000 acres, destroyed more than 2,400 structures, killed fourteen people, and caused more than $2 billion in damages.[7] In 2016, wildfires burned over 1.4 million acres across the South.[8]

But 2016 was not an isolated event. Major fires have increasingly swept across the South over the last two decades, causing great damage. Massive fires in Florida in 1998 consumed over 200,000 acres,[9] while in 2007 a single wildfire destroyed over 600,000 acres in Florida and Georgia[10] and caused $58 million of timber loss.[11] In 2008, fires in South Carolina burned thousands of acres, "destroyed or damaged 176 homes and caused economic losses in excess of $50 million."[12]

The risk of wildfire in the South is accentuated because of high population densities in the region. Eighty million people live in the Southeast, and it has the highest population of any U.S. region at the wildland-urban interface.[13] More than 70% of the 50,000 U.S. communities at the wildland-urban interface designated as "at risk" for fire are in southern states.[14]

So, how does climate change affect an already combustible situation? Primarily through temperature increases, changes in precipitation and resulting drought conditions, and through a variety of secondary effects.

Climate change is expected to increase temperatures in the region, and "general circulation models" predict air temperature will increase by 1.5 to 3 degrees Celsius over the next fifty years.[15] The expected

6 *Mayor: 3 dead in Tennessee wildfires*, CBS NEWS (Nov. 29, 2017, 5:03 PM), https://www.cbsnews.com/news/gatlinburg-fire-pigeon-forge-evacuated-tennessee/ (14,000 people evacuated).

7 Steve Ahillen, *Chimney Tops Trail in Smokies, Where Gatlinburg Fire Started, to Reopen*, KNOX NEWS (Oct. 3, 2017, 3:29 PM), https://www.knoxnews.com/story/news/local/tennessee/gatlinburg/2017/10/03/chimney-tops-trail-smokies-where-gatlinburg-wildfire-started-reopen/728523001/.

8 Lyndsey Gilpin, *The Southeast is Becoming a Wildfire Hotspot*, FIVE THIRTY EIGHT: SCIENCE & HEALTH (Dec. 8, 2016, 11:23 AM), https://fivethirtyeight.com/features/the-southeast-is-becoming-a-wildfire-hotspot/.

9 WEAR & GREIS, *supra* note 2, at 510.

10 *Id.*

11 Mitchell et al., *supra* note 3, at 319.

12 WEAR & GREIS, *supra* note 2, at 510.

13 Gilpin, *supra* note 8.

14 WEAR & GREIS, *supra* note 2, at 531.

15 Mitchell et al., *supra* note 3, at 316.

number of days above 90 degrees Fahrenheit in the Southeast will increase from approximately seventy-five days on average in the 1960s and 1970s to over 150 days by the end of the century.[16]

Temperature increases have an effect on wildfires independent of effects on precipitation patterns, since rising temperatures increase evapotranspiration, which causes trees to pull even more moisture from the soil.[17] This, in turn, means a dryer overall environment and increased wildfire risk.[18] One of the most startling assessments of recent climate reports—especially given the Southeast's status as one of the most biodiverse regions of the United States—is that "the potential savannafication of the SE, in which forests are converted into more open woodlands due to a combination of hotter and drier conditions, could be one of the most profound potential climate change impacts in the United States."[19]

Models are less clear on overall precipitation patterns. Some project a wetter Southeast overall, whereas others project a drier one.[20] Regardless, there will be more variability in precipitation patterns and extended periods of drought, like we saw in 2016, which, in turn, is expected to increase wildfire activity. Since the 1980s, droughts have become more frequent in the Southeast. Perhaps most importantly, both drier and wetter cycles will last longer in the future.[21] In 2016, 47 million people lived in drought-affected areas in the southeastern United States.[22] Tuscaloosa, Alabama, went sixty-five days without rain—the previous record was thirty-seven days.[23] Cedartown, Georgia, went ninety-four days without rain—the previous record was thirty-six days.[24]

In addition to temperature and precipitation, climate change will create a number of secondary effects. Consider insect and pest out-

16 Tom DeGomez, *Invasives in Southern U.S. Forests*, EXTENSION (May 16, 2011), http://articles.extension.org/pages/58377/invasives-in-southern-us-forests.

17 Steven McNulty et. al., *Forests and Climate Change in the Southeastern USA*, *in* CLIMATE OF THE SOUTHEAST UNITED STATES 166 (Keith T. Ingram et. al. ed., 2013).

18 *Id.*

19 *Id.*

20 Mitchell et. al., *supra* note 3, at 320.

21 Nsikan Akpan, *How Big Droughts, Forest Fires Could be the New Normal in Appalachia*, PBS NEWSHOUR (Nov. 22, 2016, 6:51 PM), https://www.pbs.org/newshour/science/widespread-forest-fires-claims-may-signal-new-normal-appalachian-mountains.

22 *Id.*

23 Andrea Thompson, *What a Warmer Future Means for Southeastern Wildfires*, CLIMATE CENTRAL (Nov. 23, 2016), http://www.climatecentral.org/news/warmer-future-southeastern-wildfires-20912.

24 *Id.*

breaks. Warmer temperatures brought about by climate change contribute to fewer insect die-offs in the winter and more insect outbreaks.[25] The woolly adelgid of the Great Smoky Mountains, for example, sucks sap from hemlocks, killing them and leaving behind more standing dead trees which are then more susceptible to fire.[26]

An inability of tree species to migrate along with rapid habitat shifts will also leave more forests susceptible to fire. Migration of tree species following the last ice age likely occurred at much slower rates than what would be required to keep pace with current and future climate change.[27] Molecular work using chloroplast DNA suggests these paleo-rates were less than 100 meters per year, yet current global temperature bands are shifting poleward at rates exceeding 1000 meters per year.[28] This will leave more dead trees in the wake of habitat shifts.

The wildland-urban interface and longer drought periods also create a cyclical problem of constraining prescribed burning. Approximately 8 million acres of land are treated with prescribed fire in the South annually—more than in all other regions of the United States combined.[29] In the Southeast, more than two-thirds of areas burned are prescribed burned, while less than one-third are burned by wildfires.[30] The ratios are reversed in the rest of the United States.[31] Prescribed burning is necessary to keep fuels from building up and to prevent more catastrophic wildfires. But because population in the South is increasing at a rate faster than any other region,[32] more people will be at the wildland-urban interface.[33] The concern that prescribed burns will escape and damage property will likely chill their use, even though all states in the Southeast have passed laws limiting

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25 *Hemlocks Declining Fast*, COMPASS, Feb. 2008, at 24.

26 Gilpin, *supra* note 8.

27 MCNULTY ET AL., *supra* note 17, at 172.

28 *Id.*

29 WEAR & GREIS, *supra* note 2, at 509.

30 Mitchell et al., *supra* note 3, at 319.

31 *Id.*

32 *The South Is Home to 10 of the 15 Fastest-Growing Large Cities*, UNITED STATES CENSUS BUREAU (May 25, 2017), https://www.census.gov/newsroom/press-releases/2017/cb17-81-population-estimates-subcounty.html.

33 Tim Henderson, *Americans Are Moving South, West Again*, THE PEW CHARITABLE TRUST (Jan. 8, 2016), http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2016/01/08/americans-are-moving-south-west-again.

liability for prescribed burns that "escape" into surrounding areas.[34] Longer drought periods mean that there are fewer windows to perform prescribed burns because the risk of escape during drought is increased. Longer wet periods also mean there will be fewer windows to set fires that will actually burn. Additionally, citizens will have concerns about smoke and particulate matter affecting air quality.[35]

Finally, wildfires are not the only disasters that plague the South, and many of the others that do also contribute to wildfire risk. The Southeast suffered the highest number of billion-dollar weather and climate-related disasters between 1980 and 2012,[36] according to the National Climate Assessment. Consider that a single hurricane can convert the equivalent of 10% of the total annual carbon sequestered by forests across the United States into dead and downed biomass in southeastern forests, which increases fuel loads when wildfire breaks out.[37]

Ultimately, studies project that the annual acreage burned by wildfires will increase by 4% across the Southeast by mid-century, and will be even greater by the end of the century,[38] with the severity of wildfire increasing by over 10%.[39] Some models project that the fire seasons for the entire southern United States will be two to three months longer on average by the end of the century.[40]

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34 WEAR & GREIS, *supra* note 2, at 532. Tennessee has since passed similar legislation. *See* TENN. CODE ANN. § 11-4-1003 (2012).

35 WEAR & GREIS, *supra* note 2, at 532.

36 Bob Berwyn, *The Southeast is Burning: Wildfires Feast on Hot, Dry Region*, INSIDE CLIMATE NEWS (Nov. 30, 2016), https://insideclimatenews.org/news/30112016/southeast-wildfires-drought-tennessee-north-carolina-georgia.

37 Mitchell et al., *supra* note 3, at 321.

38 Jeffrey P. Prestemon et al., *Projecting Wildfire Area Burned in the South-Eastern United States, 2011-60*, 25 INT'L J. WILDLAND FIRE 715, 726 (2016).

39 Livia Marqués, *The Fate of Southern Forests: Impacts of Climate Change and Variability*, COMPASS, Feb. 2008, at 3.

40 Mitchell et al., *supra* note 3, at 321.

II
CHALLENGES FOR ADDRESSING GROWING WILDFIRE RISK IN THE SOUTH

So what challenges do policy-makers in the South face for addressing climate-driven wildfire risk? Some might say it is the policy-makers themselves. Southeastern states lack meaningful direct forest and other natural resource management policies, and also lack meaningful land use planning policies that could be harnessed to protect populations at the wildland-urban interface. This is in contrast to many states in other regions of the United States that place more robust, state-driven regulatory responsibilities on private forest managers and local government land use planners.

Regarding forest management regulations, McDermott et al. found that the U.S. South maintains some of the laxest regulatory policies on forest management of any global region studied.[41] The policies reviewed included those aimed at direct, substantive forest management (or basic silvicultural) practices, like the creation of riparian buffer zones in forested watersheds, clear cutting limitations, reforestation requirements, among others.[42] On a scale of one to ten, the State of California and the U.S. Forest Service each scored a nine, maintaining robust forest policy standards.[43] The State of Washington scored an eight on the scale, while Oregon scored a seven, Idaho scored a five, and Alaska scored a four.[44] Lowest on the scale were Montana with a 2.5, Louisiana and Virginia with a two, and the entire rest of the southeastern United States—Alabama, Arkansas, Georgia, Mississippi, North Carolina, South Carolina, and Texas—with a score of one.[45] To provide context for the southeastern states' level of forest policy stringency, consider that developing countries averaged a 6.7 on the scale,[46] while nine southeastern states averaged a 1.2, maintaining entirely voluntary guidelines.[47] While this regulatory state of affairs does not mean that southeastern forests are necessarily managed

41 CONSTANCE L. MCDERMOTT ET AL., GLOBAL ENVIRONMENTAL FOREST POLICIES: AN INTERNATIONAL COMPARISON 327 tbl.10.7. (2010).

42 *Id.* at 15−19.

43 *Id.* at 327 tbl.10.7.

44 *Id.*

45 *Id.*

46 *Id.* at 328 tbl.10.8.

47 *Id.* at 327 tbl.10.7.

worse than developing world forests,[48] the lack of a forest policy regulatory framework makes it difficult to craft anew or adapt forest policy to address emerging issues like increasing climate-induced wildfire risks.

The South also has some of the laxest land use regulations in the country in general, and its propensity to develop land at the expense of natural resources places increasingly more people at the wildland-urban interface. Southern cities sprawl worse than cities in any other region of the United States.[49] Population and economic growth have increased more rapidly in the South than any other region, "with the resulting urbanization steadily consuming forests and other rural lands."[50] From 1970 to 2010, population in the South grew by 88%,[51] and from 1990 to 2008, population in the South grew at a rate approximately one-third faster than the nation as a whole.[52] Growth of southern urban regions is not expected to slow down anytime soon—population in the South is expected to grow yet another 40%–60% from 2010 to 2060.[53]

Consider the rank of southern U.S. cities in the context of sprawl. The United States' most sprawling small metro area is Hickory, North Carolina; its most sprawling medium-sized metro area is Baton Rouge, Louisiana; and its most sprawling large metro area is Atlanta, Georgia.[54] So, small, medium, or large, southern cities are the most sprawling. In fact, eight of the ten most sprawling metro areas nationally are in southern states.[55] When sorted into small, medium, and

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48 *Id.* at 350. ("[I]t cannot be assumed that regions with higher levels of regulation are actually performing better than those with lesser levels.") Lack of enforcement, corruption, insufficient property regimes, and other implementation issues may render forest standards on the books far less effective than voluntary standards in countries with better management practices on the ground or a better sense of corporate responsibility among timber companies. *See id*. at 10.

49 Blake Hudson, *The Natural Capital Crisis in Southern U.S. Cities*, 92 CHI.-KENT L. REV. 529, 530 (2017).

50 DAVID N. WEAR & JOHN G. GREIS, U.S. FOREST SERV., THE SOUTHERN FOREST FUTURES PROJECT: SUMMARY REPORT 5 (Draft Report, 2011), http://www.srs.fs.usda.gov/futures/reports/draft/summary_report.pdf.

51 *Id.* at 6 fig.2.

52 *Id.* at 71.

53 *Id.* at 12–13.

54 SMART GROWTH AM., MEASURING SPRAWL 2014, 4 (2014), https://www.smartgrowthamerica.org/app/legacy/documents/measuring-sprawl-2014.pdf.

55 These include Kingsport/Bristol/Bristol, Tennessee-Virginia; Augusta/Richmond County, Georgia-South Carolina; Greenville/Mauldin-Easley, South Carolina; Baton Rouge, Louisiana; Nashville-Davidson/Murfreesboro/Franklin, Tennessee; Clarksville,

large categories, seven of the top ten most sprawling large metro areas are southern,[56] all ten of the top ten most sprawling medium metro areas are southern,[57] and seven of the top ten most sprawling small metro areas are southern.[58] Of the 221 metro areas analyzed in one recent sprawl report, thirty-eight of the forty-five most sprawling regions of the United States are in the South.[59] This level of unchecked and largely unplanned growth not only places more people at the wildland-urban interface, but does so without adequate consideration of potential fire risk today or in a climate-changed future.

The lack of direct forest regulation (including fire policy, as discussed in the next section) combined with the lack of land use regulation that could, at the most, steer people clear of expanding the wildland-urban interface and, at the least, require planners to consider wildfire risk when planning developments, leaves the South ill-equipped to deal with ever-increasing wildfire risk.

III
ADDRESSING INCREASED WILDFIRE RISK IN THE SOUTH

There are at least two avenues that southern policy-makers might take to address climate-driven increases in wildfire risk—forestry and land use related wildfire control regulations and the development of markets to alleviate fuel build-up on the forest floor. Below is a brief sketch of the current state of affairs regarding forest wildfire policies, land use regulation, and bioenergy markets in southern states, and

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Tennessee-Kentucky; Atlanta/Sandy Springs/Marietta, Georgia; and Hickory/Lenoir /Morganton, North Carolina. *Id.* at 6 tbl.5.

56 These include Houston/Sugar Land/Baytown, Texas: Richmond, Virginia; Birmingham-Hoover, Alabama; Memphis Tennessee-Mississippi-Arkansas; Charlotte /Gastonia-Rock Hill, North Carolina-South Carolina; Nashville/Davidson/Murfreesboro /Franklin, Tennessee; and Atlanta-Sandy Springs/Marietta, Georgia. *Id.* at 7 tbl.6.

57 These include Little Rock/North Little Rock/Conway, Arkansas; Durham/Chapel Hill, North Carolina; Jackson, Mississippi; Knoxville, Tennessee; Columbia, South Carolina; Chattanooga, Tennessee-Georgia; Greensboro/High Point, North Carolina; Augusta/Richmond County, Georgia-South Carolina; Greenville/Mauldin-Easley, South Carolina; and Baton Rouge, Louisiana. *Id.* tbl.7.

58 These include Fort Smith, Arkansas-Oklahoma; Lynchburg, Virginia; Winston-Salem, North Carolina; Florence, South Carolina; Kingsport/Bristol/Bristol, Tennessee-Virginia; Clarksville, Tennessee-Virginia; and Hickory/Lenoir/Morganton, North Carolina. *Id.* at 8 tbl.8.

59 *Id.* at 19–20.

how each may be more effectively utilized to address wildfire risk in the South.

Regulations related directly to forest management and wildfire in the South range from restrictions on the lighting of fires by citizens during drought conditions,[60] tax assessments for fire prevention and fighting,[61] certification and notice requirements for those engaged in prescribed burning,[62] and limitations on liability for prescribed burns that get out of control.[63] Southern states also maintain voluntary best management practices detailing the proper construction and maintenance of firebreaks, access to water supplies, location of timber staging areas, and methods of prescribed burning.[64] However, these are only *suggestions* for good forestry practices and are not regulatory requirements. In short, the regulations in place are not enough to ensure meaningful adjustments in substantive forest management practices, and the best management practices have no regulatory teeth since they are voluntary. As climate exacerbates wildfire risk, southern states should adapt their forest policy regulatory framework to provide more robust mechanisms for controlling fire risk.

Southeastern states could take a cue from western states like California, Nevada, Idaho, Oregon, and Montana which maintain numerous forest management regulations to mitigate fire risk.[65] These in-

60 *See, e.g.*, ALA. CODE §§ 9-13-140 to -142 (2018); FLA. STAT. ANN. § 590.081 (West 2018); GA. CODE ANN. § 12-6-17 (West 2017); KY. REV. STAT. ANN. § 149.401(West 2017); MISS. CODE. ANN. § 49-19-351 (West 2017); N.C. GEN. STAT. ANN. § 106-908 (West 2018); S.C. CODE ANN. § 48-31-10 (2017); TENN. CODE ANN. § 8-1-108 (West 2017); VA. CODE ANN. § 10.1-1158 (West 2017).

61 *See, e.g.*, ALA. CODE §§ 9-13-180 to -198.

62 *See, e.g.*, ALA. CODE §§ 9-13-140 to -142, -188 to -198, -270 to -274 (2018); N.C. GEN. STAT. ANN. §§ 106-965 to -969 (West 2018); *See* ARK. CODE ANN. § 20-22-302 (a)(1) (West 2017); FLA. STAT. ANN. § 590.125 (2)(b) (West 2017); GA. CODE ANN. §§ 12-6-90; 12-6-148 to -149 (West 2017); KY. REV. STAT. ANN. § 149.175 (West 2017); LA. STAT. ANN. § 3:17 (West 2017); N.C. GEN. STAT. ANN. § 106-968 (West 2018); S.C. CODE ANN. § 48-34-60 (West 2017); VA. CODE ANN. § 10.1-1150.2 (West 2017).

63 *See, e.g.*, ALA. CODE §§ 9-13-140 to -142, -188 to -198, -270 to -274 (West 2018); N.C. GEN. STAT. ANN. § 106-967 (West 2017); ARK. CODE ANN. § 20-22-302(c) (West 2017); FLA. STAT. ANN. § 590.125(3)(b)7(c) (West 2017); LA. STAT. ANN. § 3:17(E) (West 2017); MISS. CODE ANN. § 49-19-307 (West 2017); N.C. GEN. STAT. ANN. § 106-967 (West 2018); S.C. CODE ANN. § 48-34-50 (West 2017); TENN. CODE ANN. § 11-4-1003 (West 2017); VA. CODE ANN. § 10.1-1150.5 (West 2017).

64 *See, e.g.*, GA. FORESTRY COMM'N, GEORGIA'S BEST MANAGEMENT PRACTICES FOR FORESTRY (2009); TENN. DEP'T. OF AGRIC., GUIDE TO FORESTRY BEST MANAGEMENT PRACTICES IN TENNESSEE (2003).

65 CAL. CODE REGS. tit. 14, §§ 917, 937, 957 (2018). *See also* NEV. REV. STAT. ANN. § 528.070 (West 2017); IDAHO CODE ANN. §§ 38-122, -123 (West 2017); OR. REV. STAT.

clude standards for removing and handling snags (standing dead or dying trees) and logging slash (materials left on the forest floor after timber operations) to reduce the risk of wildfire.[66] Requirements include piling and burning slash within a given timeframe; burning, burying, or removal of slash or snags within a given distance from public roads, habitable structures, trails, and campgrounds;[67] issuance of burn permits; and even restrictions on smoking, as well as restrictions on lunch and warming fires in areas subject to timber operations.[68] Western states further regulate the types of equipment (including chainsaws, vehicles, and other engined devices) and modes of use for such equipment within state and private forests.[69] These policies constitute more direct mechanisms for regulating substantive forest management activities to mitigate wildfire risk. Though southern states have been reticent to implement substantive mandates on private landowner forest operations, the growing risk of wildfire should prompt a change in course.

Southern jurisdictions could also engage in more robust land use planning to control the borders of the wildland-urban interface. It is true that southern state and local governments are reticent to prescriptively regulate land use. Even so, better controlling and restricting the expansion of urban areas into greenfields (often forests) and giving forethought to potential wildfire risk in the land use planning process can help reduce damage to human structures when wildfires do occur.[70] Policies might include anything from regulating the number of structures in an area and how far they are set back from natural features, to the types of materials used in construction, to vegetation

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ANN. § 477.580 (West 2017); MONT. ADMIN. R. 36.10.119–.131 (2018); OR. ADMIN. R. 629-043-0005 (2017).

66 CAL. CODE REGS. tit. 14, §§ 917, 937, 957 (2018). *See also* NEV. REV. STAT. ANN. § 528.070 (West 2018); IDAHO CODE ANN. § 38-122 to 123 (West 2018); OR. REV. STAT. ANN. § 477.580 (West 2018); OR. ADMIN. R. 629-043-0005 (2017).

67 CAL. CODE REGS. tit. 14, §§ 917.3, 937.3, 957.3 (West 2018). *See also* NEV. REV. STAT. ANN. § 528.070 (West 2017); IDAHO CODE ANN. §§ 38-122, -123 (West 2017); OR. REV. STAT. ANN. § 477.580 (West 2017); OR. ADMIN. R. 629-043-0005 (2017).

68 CAL. CODE REGS. tit. 14, §§ 918, 938, 958 (2018).

69 CAL. PUB. RES. CODE tit. 14, §§ 4597.8–4597.12 (West 2018). *See also* IDAHO CODE ANN. § 38-121 (West 2017); OR. ADMIN. R. 629-043-0015, 0036 (2017); MONT. ADMIN. R. 36.10.126 (2018).

70 *See* Alexandra D. Syphard, Avi Bar Massada, Van Butsic & Jon E. Keeley, *Land Use Planning and Wildfire: Development Policies Influence Future Probability of Housing Loss*, 8 PLOS ONE, Aug. 2013, at 1, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3743760/.

management and other regulatory policies.[71] Montana, for example, requires cities and counties to adopt subdivision regulations that, among other things, identify areas unsuitable for development because of wildfire risk and prohibit development in those areas unless risks can be avoided through construction or mitigation.[72] As noted earlier, the South is lacking in land use regulations that restrict the pace and location of development. But a change of course is needed to reduce harm to human life and property from wildfires that will inevitably occur.

Another potential tool to mitigate growing wildfire risk is the development of woody biomass markets. Such markets allow potential forest fuels to be burned somewhere other than the forest—such as in electricity production facilities. Historically reliable markets for southern timber owners, like pulp and paper, have shrunk in recent decades, and timber managers are concerned that forest fuels might accumulate even while the risk of wildfire is becoming greater. Consider that:

> [C]oncerns about southern timber markets have shifted from a focus on supply issues to a focus on demand issues. . . . The question is whether future demand will rise as fast as the available supply. Evidence does not support continuing strong demand for pulpwood, at least not for paper production. . . . Customer demand for engineered wood products is increasing, but so far, rising demand for these products has not been sufficient to offset declines in demand for pulpwood by the paper sector.[73]

Indeed, from 1998 to 2008, the forest products industry divested approximately 75% of its timberland holdings.[74] This divestiture combined with shrinking markets may lead to more forest biomass on the forest floor which can become wildfire fuel. It may also lead to forest owners converting forests to non-forest uses, placing more people and structures at the wildland-urban interface. In the presence of these shrinking markets, and if prescribed burning becomes more limited due to the drier/wetter cycle detailed above, then, as one scientific report argues, "[h]arvests for biomass utilization [for power gen-

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71 *See generally* Planning For Hazards: Land Use Solutions for Colorado, *Land Use Tool: Wildland-Urban Interface Code*, PLANNING FOR HAZARDS, https://planningforhazards.com/wildland-urban-interface-code-wui-code (last visited Apr. 4, 2018).

72 Headwaters Economics, *Montana Land Use Planning Strategies to Reduce Risk in the Wildland-Urban Interface*, 11 (2017), https://headwaterseconomics.org/wp-content/uploads/Montana_WUI_Planning_Strategies_Report.pdf.

73 Marqués, *supra* note 39, at 5.

74 WEAR & GREIS, *supra* note 2, at 103.

eration] show the greatest promise as fuel reduction techniques."[75] Others have argued that "land managers have identified mechanical thinning as a way to reduce the risk of stand-replacing fire . . . and potentially reap value from the harvested biomass."[76]

One form of biomass increasingly used for energy production, wood pellets, has the market potential to both reduce wildfire risk and help keep southern forests forested rather than converted to expanded wildland-urban interfaces.[77] Wood pellets are increasingly used to power electric generation facilities in Europe and to provide electricity and heating in a growing number of other countries.[78] At present, global wood pellet demand is being supplied primarily by southern U.S. forests, and some in the environmental community have looked upon this as an environmental negative—the science is unsettled as to whether the burning of wood pellets for energy is a net climate positive or negative.[79] But it does seem clear that such markets at least provide a mechanism for removing fuel loads in forests without running the risk of runaway fire or damage at the wildland-urban interface that might result from prescribed burning. Wood pellet markets have expanded rapidly over the last decade or so, and dozens of manufacturers are concentrated in the Southeast at present, with many more in development.[80] The United States is the single largest wood pellet producer in the world, and while exports from the United States to Europe doubled between 2012 and 2013, they are projected to increase another 65% by 2019.[81] Indeed, even as pulp and paper mills have been closing down over the last twenty years, even more wood pellet plants have opened to fill the void.[82] These expanding markets,

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75 Mitchell et al., *supra* note 3, at 322; *see also* Greg Jones, Dan Loeffler, David Calkin & Woodam Chung, 2010. *Forest Treatment Residues for Thermal Energy Compared with Disposal by Onsite Burning: Emissions and Energy Return*, 34 BIOMASS BIOENERGY 737–38 (2010) (discussing the efficacy of mechanical fuel treatments to reduce "hazardous fuels and the effect of severe wildfire").

76 Jeremy Fried & Jamie Barbour, *Bioenergy from Trees: Using Cost-Effective Thinning to Reduce Forest Fire Hazards*, 117 SCI. FINDINGS 1, 1 (2009).

77 *See* Blake Hudson, *Harnessing Energy Markets to Conserve Natural Resources? The Case of Southern U.S. Forests*, 44 FLA. ST. U. L. REV. 112 (forthcoming 2018) (manuscript at 37–38) (available at SSRN: https://ssrn.com/abstract=2799256).

78 *Id.* at 37.

79 *Id.* at 26−27.

80 *Id.* at 37–38.

81 *Id.* at 37.

82 *Id.* at 38.

if sustained, provide an opportunity for southern forest owners to mechanically thin their forests and reap economic reward while also reducing wildfire risk.

CONCLUSION

Though the suggestions made in this Article are merely slight adjustments to how regulatory regimes and forest product markets currently work in the southeastern United States, each may prove necessary to mitigate the growing risk of wildfire in southern forests. With the climate of the South changing rapidly relative to geologic timescales, southern policy-makers and forest managers must choose to change with it. Otherwise, they risk making an already combustible situation much worse.