RESTORING THE SUSTAINABILITY OF FREQUENT-FIRE FORESTS OF THE ROCKY MOUNTAIN WEST

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I. THE CONTEMPORARY CONTEXT FOR FIRE AND FOREST MANAGEMENT IN THE ROCKY MOUNTAIN WEST[1]

The ecological, social, and economic sustainability of the Rocky Mountain West is threatened by declining forest health that is manifested by unnaturally high tree densities and fuel loads, increases in invasive exotic plants, decreasing biological diversity (plants and animals), and increased insect and disease outbreaks (Box 1).[2] These unnatural fuel loads lead to wildfires that have become unprecedented in their severity, acreage, and effects (Box 2).[3] In this paper we discuss the causes of forest health decline and advocate for ecological restoration as an approach for restoring forest health. We also summarize recent policy changes with the stated purpose to accelerate restoration and provide economic validation for why restoration is the smartest approach for reducing the threat of catastrophic fire.

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1. This paper was revised and updated from an article entitled *Restoring the Ecological and Economic Integrity of Forested Landscapes of the Rocky Mountain West* that first appeared in the proceedings from the Pay Dirt Conference sponsored by Western Progress on October 3, 2007 in Missoula, Montana.

2. *See* Bruce R. Hartsough et al., *The Economics of Alternative Fuel Reduction Treatments in Western United States Dry Forests: Financial and Policy Implications from the National Fire and Fire Surrogate Study*, 10 FOREST POL'Y & ECON. 344, 344–54 (2008).

3. *See, e.g.*, *id.*; *Understanding Fire Effects on the Environment*, U.S. FOREST SERV., http://www.fs.fed.us/pnw/research/fire/fire-effects.shtml (last visited Mar. 3, 2016).

Box 1: Symptoms of declining ecosystem health

- Loss of herbaceous cover
- Increased erosion
- Tree population explosions
- Watershed degradation
- Loss of plant and animal diversity
- Loss of esthetic values
- Unnatural insect and disease epidemics
- Shift to catastrophic crown fires
- Destruction of human and wildlife habitats

Box 2: Environmental impacts of landscape-scale fires

- Costs of fire suppression
- Homes and infrastructure
- Wildlife and human habitats
- Watersheds and water supply
- Recreation facilities
- Evacuation costs
- Tourism
- Timber
- Cultural and archaeological sites
- Rehabilitation and restoration
- Public health

A. Forest Health

As early as 1924, conservationist Aldo Leopold warned that forests in southern Arizona were manifesting symptoms of ill health.[4] From the 1930s through the 1960s, other foresters, including Elers Koch (Lolo National Forest in Montana), Harold Weaver (Pacific Northwest and California), Harold Biswell (California), and Charles F. Cooper (Southwest), all noted increasing symptoms of ecological decline that included unnatural fire and

4. Aldo Leopold, *Grass, Brush, Timber, and Fire in Southern Arizona*, 22 J. FORESTRY 1, 1–2 (1924), http://www.nps.gov/seki/learn/nature/upload/leopold24.pdf.

unprecedented disease and insect outbreaks.[5] In concert with other human-induced changes (e.g., logging, grazing, etc.), the elimination of fire's natural role as the regulator of tree populations, fuel build-up, and nutrient recycling has created the forest health crisis confronting forests today in the Rocky Mountain West.[6] These forests are in poor health because they are outside their natural range of variability and now manifest signs of comprehensive ecosystem decline.[7]

B. Forest Fires

Despite fire's potential for destruction, surface fire is an important ecological process in the forests of the Rocky Mountain West.[8] In fact, ponderosa pine forests are referred to as "frequent-fire forests" because they have adapted to regularly occurring surface fire during their thousands of years of co-evolution.[9] Catastrophic wildfire (fire that burns through the crowns or tops of trees) is a recent phenomenon of the last twenty-five years in the ponderosa pine forests of the Rocky Mountain West and is one of many symptoms of degraded forest health.[10]

Suppressing fire has been at the center of forest policy since the earliest days of the federal land management agencies.[11] Severe fires between 1910 and 1935 resulted in the loss of many lives and significant property damage.[12]

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5. *See, e.g.*, H. H. Biswell, *Danger of Wildfires Reduced in Ponderosa Pine*, CAL. AGRIC., Oct. 1960, at 5, 5–6; C.F. Cooper, *Changes in Vegetation, Structure and Growth of Southwestern Pine Forests Since White Settlement*, 30 ECOLOGICAL MONOGRAPHS 129, 161–62 (1960); Elers Koch, *History of the 1910 Forest Fires—Idaho & Western Montana*, THE FOREST HIST. SOC'Y, http://www.foresthistory.org/ASPNET/Publications/region/1/1910_fires/sec1.htm (last visted Feb. 14, 2016); Harold Weaver, *Fire as an Ecological and Silvicultural Factor in the Ponderosa-Pine Region of the Pacific Slope*, 41 J. FORESTRY 7, 7–15 (1943).

6. *See* CHARLES LUCE ET AL., U.S. FOREST SERV., RMRS-GTR-290: CLIMATE CHANGE, FORESTS, FIRE, WATER, AND FISH: BUILDING RESILIENT LANDSCAPES, STREAMS, AND MANAGERS 39–51 (2012).

7. W. Wallace Covington & Margaret M. Moore, *Southwestern Ponderosa Forest Structure*, 92 J. FORESTRY 39, 45–46 (1994), http://library.eri.nau.edu/gsdl/collect/erilibra/archives/HASH01c1.dir/doc.pdf.

8. *See* LUCE ET AL., *supra* note 6, at 26–27.

9. Covington & Moore, *supra* note 7, at 40.

10. *See* U.S. FOREST SERV., INFLUENCE OF FOREST STRUCTURE ON WILDFIRE BEHAVIOR AND THE SEVERITY OF ITS EFFECTS, 1–2 (2003), http://www.fs.fed.us/projects/hfi/2003/november/documents/forest-structure-wildfire.pdf.

11. *U.S. Forest Service Fire Suppression*, FOREST HIST. SOC'Y, http://www.foresthistory.org/ASPNET/Policy/Fire/Suppression/Suppression.aspx (last visited Mar. 3, 2016).

12. *See, e.g.*, *The 1910 Fires*, FOREST HIST. SOC'Y, http://www.foresthistory.org/ASPNET/Policy/Fire/FamousFires/1910Fires.aspx (last visited Feb. 14, 2016).

These tragedies buttressed the argument for a national fire policy focused on fire suppression.[13] At the time, fire was viewed as a threat to natural resource commodities, economic development, and the ecological stability of the forest, not as a vital ecological process.[14] By the mid-twentieth century, Smokey Bear became the endearing symbol of fire protection and a renowned education tool for protecting forests from fire.[15] Smokey, and the fire fighters who efficiently "prevented forest fires," reduced the risk of fire—enabling the issue to drop from the public and policy spotlight.[16]

It could not stay that way, however. Fire suppression may have been viewed as eliminating big fires from the forest, but in reality aggressive suppression merely put them off. In the 1990s, the long-deferred "fuel bill" came due with a vengeance.[17] Eighty years of fire suppression, continuous fuel build-up, and drought combined in the late 1980s and early 1990s to create the conditions for fires that were unprecedented in size, intensity, and severity for the frequent-fire forests of the Rocky Mountain West (i.e., ponderosa pine and other dry forest types).[18] No longer a phenomenon of the back country, fires leapt from the forest and spread into the wildland-urban interface ("WUI") where rampant population growth and residential development has expanded despite the fuel-laden forest at their door step.[19]

In response to the shocking loss of thirty-four lives during wildfires in 1994, the Department of Interior and Department of Agriculture developed a comprehensive federal fire policy.[20] In 1995, diverse interests (the public, federal and state agencies, and other political entities) began to focus greater attention on solving the underlying problem of degraded forest health that contributed to unnatural wildfire.[21] Yet, while more than one hundred years of scientific research supports the importance and role of natural fire,

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13. *U.S. Forest Service Fire Suppression*, *supra* note 11.

14. U.S. DEP'T OF THE INTERIOR ET AL., REVIEW AND UPDATE OF THE 1995 FEDERAL WILDLAND FIRE MANAGEMENT POLICY 1 (2001), https://www.nifc.gov/PIO_bb/Policy/FederalWildlandFireManagementPolicy_2001.pdf.

15. *See* *American Icon*, SMOKEY BEAR, http://www.smokeybear.com/vault/history_main.asp (last visited Feb. 14, 2016); *History of Smokey Bear*, S.D. DEP'T OF AGRIC., http://sdda.sd.gov/legacydocs/forestry/educational-information/pdf/history-of-smokeybear.pdf.

16. *See supra* note 15 and accompanying text.

17. STEPHEN J. PYNE, TENDING FIRE: COPING WITH AMERICA'S WILDLAND FIRES 61–64 (2004).

18. *See* ROBERT E. KEANE ET AL., U.S. FOREST SERV., CASCADING EFFECTS OF FIRE EXCLUSION IN ROCKY MOUNTAIN ECOSYSTEMS 1–3 (2002), http://www.fs.fed.us/rm/pubs/rmrs_gtr091.pdf; *U.S. Forest Service Fire Suppression*, *supra* note 11.

19. KEANE ET AL., *supra* note 18, at 12.

20. *See* U.S. DEP'T OF THE INTERIOR ET AL., *supra* note 14, at 1.

21. For example, the 1995 Federal Wildland Fire Management Policy. *See id.* at 2–3.

agreeing on the management actions that are needed to reduce unnatural levels of fuel (such as mechanical thinning) still generate controversy.[22] These disagreements are based on concerns about the potential effects of thinning on aesthetics, endangered and threatened species, and old growth. Perhaps of greatest concern is the fear that mechanical treatments will re-establish a logging industry with the power to drive forest management away from ecologically-based approaches and back to commodity-based objectives that dominated the 1960s–1980s.

II. THE KEY ECOLOGICAL, POLICY, AND ECONOMIC ISSUES

A. What is a Healthy Forest?

Although there is a general consensus about what constitutes human health, there is much less agreement about the basis of forest health. In part, this lack of consensus occurs because people view forests differently. To some the forest is about trees, to others it's about wildlife and their habitats, and to others it's about entire landscapes. Some people look at forests as wildlands, some as resources to be developed and used. Opinions are diverse, even within these various groups. For example, resource-oriented interests diverge, with some viewing forests as a wood resource, while others see forests as a range or watershed resource.[23]

In seeking a unified definition of forest health, ecologists have relied increasingly upon a naturalistic definition, one that states that forests are healthy when they exist within their natural range of species composition, structure and function.[24] In this view, healthy forests would have their species composition, population dynamics, structure, and function regulated by natural processes (such as low-intensity surface fire).[25] Unhealthy forests

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22. *See* Sherri Eng, *Prescribed Burning and Mechanical Thinning Pose Little Risk to Forest Ecology*, U.S. DEP'T. AGRIC. BLOG (July 26, 2012, 12:42 PM), http://blogs.usda.gov/2012/07/26/prescribed-burning-and-mechanical-thinning-pose-little-risk-to-forest-ecology/.

23. *Compare Who We Are*, SOC'Y AM. FORESTERS, https://safnet.org/about/index.cfm (last visited Feb. 14, 2016) ("Forests must be sustained through simultaneously meeting environmental, economic, and community aspirations and needs."), *with* Alison Berry, *Literature Review: The Economic Value Of Water and Watersheds on National Forest Lands in the United States*, SONORAN INST. (Sept. 16, 2010), http://www.carpediemwest.org/wp-content/uploads/Berry-Sonoran-FS-Water-Lit-Review.pdf.

24. *See, e.g.*, Adriana Sulak & Lynn Huntsinger, *Perceptions of Forest Health Among Stakeholders in an Adaptive Management Project in the Sierra Nevada of California*, 110 J. FORESTRY 312, 312–13 (2012).

25. *Id.* at 314–15.

would have conditions such that natural processes can no longer function in a sustainable manner.[26] Ecologists and natural resource professionals refer to conditions consistent with the evolutionary environment of a particular forest type as within the "historic range of variability" or the "natural range of variability."[27]

This approach leads to a definition of forest health that varies with each forest type. If, under natural conditions, forest density is great and infrequent, stand-replacing crown fires the norm, which is often the case with lodgepole pine and spruce forests of the Rocky Mountain West, then dense forests that support crown fires would be considered healthy.[28] On the other hand, ponderosa pine and larch forests, which are characterized under natural conditions by having frequent, low-intensity surface fires, would be considered unhealthy if they have high forest density and support crown fires.[29] The key is that plants and animals are adapted to whatever conditions shaped individual ecosystems over evolutionary time, and these plants, animals and ecosystems may depend upon natural disturbance regimes and stand conditions for their very survival.[30]

Using this line of thinking, today's frequent-fire forests of the Rocky Mountain West—those dominated by ponderosa pine, larch, interior Douglas-fir, and dry mixed-conifers—are decidedly unhealthy and at risk of unnatural catastrophic disturbances such as crown fire and extensive insect and disease attack.

B. Changes in Forest Health in the Rocky Mountain West

Since Euro-American settlement in the late 1800s, overgrazing, logging, fire exclusion, introduction of exotic plants, insects, and diseases, and disruption of watersheds have led to a steady decline in forest health.[31]

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26. *Id.*

27. *See, e.g.*, Dominic Cyr et al., *Forest Management is Driving the Eastern North American Boreal Forest Outside its Natural Range of Variability*, 7 FRONTIERS ECOLOGY & ENV'T 519, 519 (2009); Daniel B. Tinker et al., *Historic Range of Variability in Landscape Structure in Subalpine Forests of the Greater Yellowstone Area, USA*, 18 LANDSCAPE ECOLOGY 427, 427 (2003).

28. Tania Schoennagel et al., *The Interaction of Fire, Fuels, and Climate across Rocky Mountain Forests*, 54 BIOSCIENCE 661, 673 (2004).

29. *Id*. at 663–64.

30. OFFICE OF THE PRESIDENT OF THE U.S., HEALTHY FORESTS: AN INITIATIVE FOR WILDFIRE PREVENTION AND STRONGER COMMUNITIES (2002), http://www.fs.fed.us/projects/documents/HealthyForests_Pres_Policy%20A6_v2.pdf; *see* W. Wallace Covington et al., *Historical and Anticipated Changes in Forest Ecosystems of the Inland West of the United States*, 2 J. SUSTAINABLE FORESTRY 13, 15–16 (1994).

31. Covington et al., *supra* note 30, at 24–28.

Nowhere are these deleterious changes greater than in the ponderosa pine and dry mixed-conifer forest types of the Rocky Mountain West. Tree seedlings became widely established once the natural, frequent surface fires were eliminated from these forests by overgrazing, landscape fragmentation, and fire suppression.[32] Repeat photography from throughout the region shows a tremendous increase in the number of trees, not only within stands,[33] but also at the landscape scale.[34] By the 1960s, these seedlings had grown into thickets of pole- and sapling-size trees and this, coupled with the steadily accumulating surface fuels of dead branches, twigs and conifer needles, led to biomass accumulations across large landscapes that fueled increasingly large, severe fires.[35]

Fortunately, forest research had developed a solution to the problem—thin out excess trees, conserve old-growth trees, and use prescribed burning to reintroduce surface fires to regulate tree density and fuel accumulation.[36] These techniques are a foundation of ecological restoration approaches for restoring forest health.

32. *Id.* at 29.

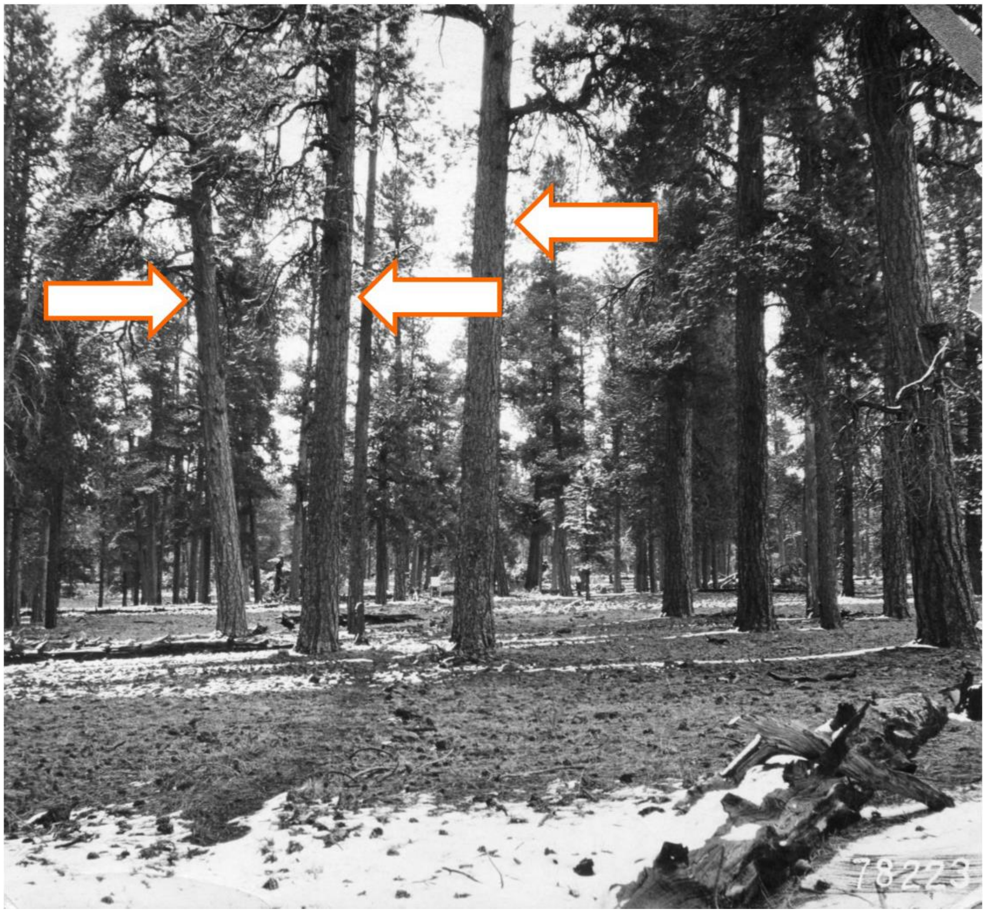
33. *See infra* Figures 1a–c.

34. *See infra* Figures 2a–b.

35. *See Preface* to SUSTAINING ROCKY MOUNTAIN LANDSCAPES: SCIENCE, POLICY, AND MANAGEMENT FOR THE CROWN OF THE CONTINENT ECOSYSTEM, xiii, xiii (Tony Prato & Dan Fagre eds., 2007).

36. *See infra* Figures 3a–b

Figure 1a[37]



The use of repeat photography allows us to see the changes in forest structure over time. Note the open forest structure in this photograph from 1909.

37. All figures courtesy of the Ecological Restoration Institute.

Figure 1b

This photo of the same stand in 1938 shows young trees and saplings filling in the gaps of the formerly open forest. This occurred in large part because fires were suppressed.

Figure 1c

A photo of the same stand taken in 2000. Note the closed forest structure of the formerly open site, the large number of small-diameter trees, and how the trees that were already on the site in 1909 have failed to grow larger in diameter.

C. What is Ecological Restoration?

Ecological restoration is a practical approach for restoring degraded ecosystems—ecosystems outside their natural range of variability in terms of composition, structure, and function/process.[38] The dictionary definition of "restoration" is the act of bringing back to an original or unimpaired condition.[39] Thus, ecological restoration has as its goal the restoration of degraded ecosystems to more closely emulate conditions that prevailed before disruption of natural structures and processes, i.e. environmental conditions that have influenced native communities over evolutionary time.[40]

Box 3: An ecological restoration prescription for frequent-fire forests

- Retain trees that predate settlement
- Retain post-settlement trees needed to reestablish pre-settlement structure
- Thin and remove excess trees
- Rake heavy fuels from base of trees
- Burn to emulate natural disturbance regime
- Seed with natives/control exotics as needed

Ecological restoration involves management actions designed to accelerate recovery of degraded ecosystems by complementing or reinforcing natural processes where possible, or by more active intervention when necessary.[41] Ecological restoration that restores forest health and resilience is also a useful strategy for maintaining forests during climate change. Properly done, it will improve the ability of the forest to withstand climate impacts.[42] Ecological restoration has been viewed as ecosystem medicine where the practitioner is helping nature heal—that is, building upon the natural recovery processes inherent in the ecosystem.[43]

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38. *See Principles of Ecological Restoration*, ECOLOGICAL RESEARCH INST. N. ARIZ. UNIV., http://nau.edu/ERI/Restoration/Ecological-Restoration/Principles/ (last visited Feb. 14, 2016).

39. *Restoration*, MERRIAM-WEBSTER DICTIONARY, http://www.merriam-webster.com/dictionary/restoration (last visited Feb. 14, 2016)

40. *Ecological Restoration*, ECOLOGICAL RESEARCH INST. N. ARIZ. UNIV., http://nau.edu/ERI/Restoration/Ecological-Restoration/ (last visited Feb. 14, 2016).

41. *Restoration Approaches*, ECOLOGICAL RESEARCH INST. N. ARIZ. UNIV., http://nau.edu/ERI/Restoration/Ecological-Restoration/Restoration-Approaches/ (last visited Feb. 14, 2016).

42. Covington et al., *supra* note 30, at 48–49.

43. *See* Jack Monschke, *How to Heal the Land*, *in* HELPING NATURE HEAL: AN INTRODUCTION TO ENVIRONMENTAL RESTORATION 114, 114–21 (Richard Nilsen ed., 1991); *see also* Susan E. Davis, *Natural Resoration: When Humans Walk Away*, *in* HELPING NATURE HEAL: AN INTRODUCTION TO ENVIRONMENTAL RESTORATION 22, 22–25 (Richard Nilsen ed., 1991).

For frequent-fire forests of the Rocky Mountain West, ecological restoration involves scientifically and economically sound fuel-reduction treatments that treat not only wildfire symptoms, but also attack the underlying causes of ecosystem health decline.[44] Such treatments would typically include thinning excess trees and reintroducing frequent, low-intensity burning.[45] Where topography is not too steep and existing roads allow for removal of these excess trees, opportunities may exist for using income from thinning to help offset restoration costs.[46] Although a somewhat more complex undertaking, the principle would be the same for the restoration of forests that under natural conditions exhibited a mixture of frequent fire and infrequent, crown fire regimes—that is, use a combination of thinning and prescribed burning as needed to restore stand densities and landscape patterns that are consistent with the evolutionary environment of the organisms constituting these forests.[47] Although there has been some discussion of the need to break up landscape-scale homogeneity for forests that had an infrequent, crown fire regime (e.g., most lodgepole pine and spruce-fir forests), it is less clear that active intervention is scientifically justified at this time.[48]

D. Policy Responses to Degraded Forest Health and Wildfire

Catastrophic fire beginning in the 1990s shocked policymakers, land management agencies, and communities into action.[49] The response by elected officials was to promulgate a series of policy initiatives focused on the restoration of forests and reduction of hazardous fuels as the best vehicle to reduce the risk of unnatural fire, disease, and beetle outbreaks.[50] Examples include the 2004 Healthy Forest Restoration Act,[51] the 2009 Federal Land

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44. Gary Snider et al., *The Irrationality of Continued Fire Suppression: An Avoided Cost Analysis of Fire Hazard Reduction Treatments Versus No Treatment*, 8 J. FORESTRY 431, 431 (2006); *see* Schoennagel, *supra* note 28, at 673–74.

45. Schoennagel, *supra* note 28, at 673.

46. *See supra* Box 3; *Principles of Ecological Restoration*, *supra* note 38.

47. *Principles of Ecological Restoration*, *supra* note 38; *see also* Marylee Guinon, *Global Warming/Global Warning: Plant the Right Tree*, *in* HELPING NATURE HEAL, *supra* note 43, at 44–45.

48. Schoennagel, *supra* note 28, at 673–74.

49. *See* Kimberly Lowe & Ann Moote, *Collaboration as a Tool in Forest Restoration*, ECOLOGICAL RESTORATION INST. N. ARIZ. UNIV. (2005), http://library.eri.nau.edu/gsdl/collect/erilibra/index/assoc/HASH016a.dir/doc.pdf.

50. Tom Tidwell, Chief, U.S. Forest Serv., Address Before the United States House of Representatives (Apr. 29, 2015), http://agriculture.house.gov/uploadedfiles/tidwell_testimony.pdf.

51. Act of Oct. 30, 2000, Pub. L. No. 106-393, 114 Stat. 1607.

Assistance, Management, and Enhancement Act (FLAME Act) and Collaborative Forest Landscape Restoration Act,[52] and the 2014 U.S. Forest Service regulation that creates a new pre-decisional National Environmental Policy Act (NEPA) objection process that is designed to resolve objections before a final Record of Decision is signed for a proposed project.[53]

There are several recurring themes throughout these policies that reflect a new approach to federal land management decision-making. These include: efforts to streamline the environmental review and appeal process; a call for incorporating the best available science into treatment design; encouraging the use of collaborative processes to guide land management action; a proposal to revamp how fires are paid for by the federal government; and urging cross-jurisdictional coordination to maximize efficiency, communication, and involvement.[54] A core motivation of the new approach has been to actively engage stakeholders early in the decision process to reduce potential conflict and gridlock that characterized forest management during the 1990s.[55] The Healthy Forest Restoration Act (HFRA) and Healthy Forests Initiative (HFI) strive to streamline environmental review processes,[56] NEPA[57] and other pieces of legislation passed during the 1960s and 1970s. These earlier laws and policies were developed in response to public demand for greater accountability, public involvement, and transparency in land management decisions.[58] Whether or not the early environmental legislation has facilitated or hindered good land management is a source of heated debate.[59] What is certain is that litigation or threats

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52. Omnibus Public Land Management Act of 2009, Pub. L. No. 111-11, 123 Stat. 991.

53. 36 C.F.R. § 218 (2013); *see Forest Service Pre-Decisional Objections*, U.S. DEP'T OF AGRIC., http://www.fs.fed.us/objections/objections_related.php (last visited Jan. 30, 2016).

54. *See generally* OFFICE OF THE PRESIDENT OF THE U.S., *supra* note 30.

55. *See, e.g.*, Lowe & Moote, *supra* note 49; *see also* OFFICE OF THE PRESIDENT OF THE U.S., *supra* note 30, at 13–20.

56. Memorandum from Dr. William T. Hogarth, Assistant Adm'r for Fisheries, Nat'l Oceanic & Atmospheric Admin., to the Regional Directors, Regions 1–7 & California & Nevada Operations (Oct. 11, 2002) (outlining "Alternative Approaches for Streamlining Section 7 Consultation on Hazardous Fuels Treatment Projects"), https://www.fws.gov/endangered/esa-library/pdf/streamlining.pdf; *see* Jesse Abrams, *Guidance on Healthy Forest Policy and Planning*, ECOLOGICAL RESTORATION INST. N. ARIZ. UNIV., http://nau.edu/eri/resources/for-practitioners/forest-policy/ (last visited Mar. 11, 2016).

57. *What is the National Environmental Policy Act?*, EPA, http://www.epa.gov/nepa/what-national-environmental-policy-act (last visited Mar. 11, 2016).

58. *See, e.g.*, OFFICE OF THE PRESIDENT OF THE U.S., *supra* note 30.

59. OFFICE OF THE PRESIDENT OF THE U.S., *supra* note 30; *cf.* U.S. FOREST SERV., THE PROCESS PREDICAMENT: HOW STATUTORY, REGULATORY, AND ADMINISTRATIVE FACTORS AFFECT NATIONAL FOREST MANAGEMENT (2002), http://www.fs.fed.us/projects/documents/Process-Predicament.pdf; U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-04-52, FOREST SERVICE: INFORMATION ON APPEALS AND

thereof, contributed to a decline in timber sales and timber harvest beginning in the 1990s.[60] Insecurity surrounding litigation combined with a changing investment climate for the wood products industry and adjustments in the international wood market, caused a decline in timber-related activity during the 1990s in the Rocky Mountain West.[61] As a result, there were fewer forest-related jobs, a loss of the private workforce, and a near elimination of the harvest infrastructure throughout much of the rural West.[62] The 1990s also saw a change in management focus from profitable commercial logging of large trees to the need to remove low or no value, small-diameter trees in order to restore forests.[63]

LITIGATION INVOLVING FUELS REDUCTION ACTIVITIES (2003), http://www.gao.gov/new.items/d0452.pdf.

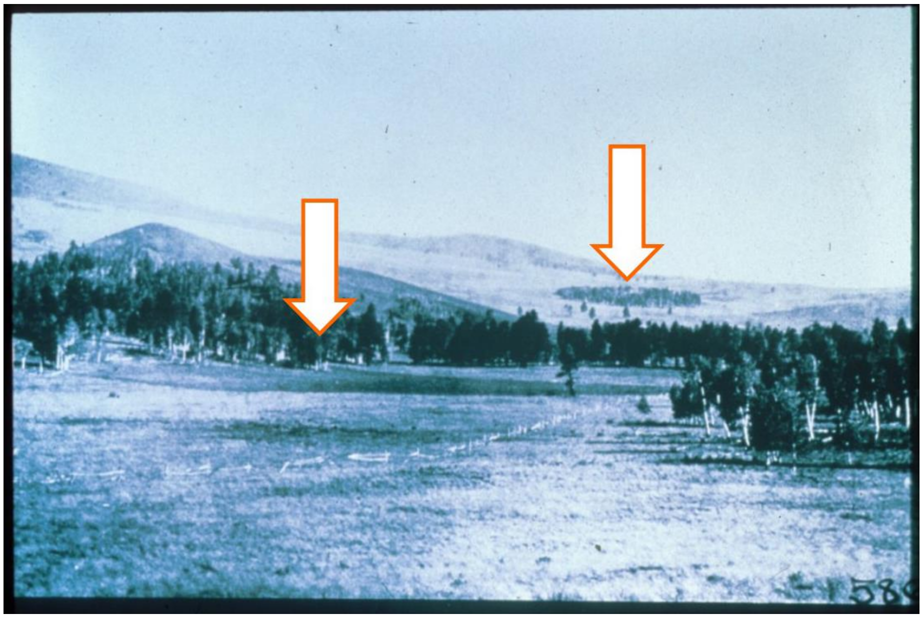
60. S. Broussard & B.D. Whitaker, *The Magna Charta of Environmental Legislation: A Historical Look at 30 Years of NEPA-Forest Service Litigation*, 11 FOREST POL'Y & ECON. 148 148–54 (2009).

61. Sally Collins, Assoc. Chief, U.S. Forest Serv., Address at the International Forum on Public Forest Reform: Forest Management Experience in the United States 4 (Sept. 27, 2005), http://forest-trends.org/documents/files/doc_1089.pdf.

62. *See id.*

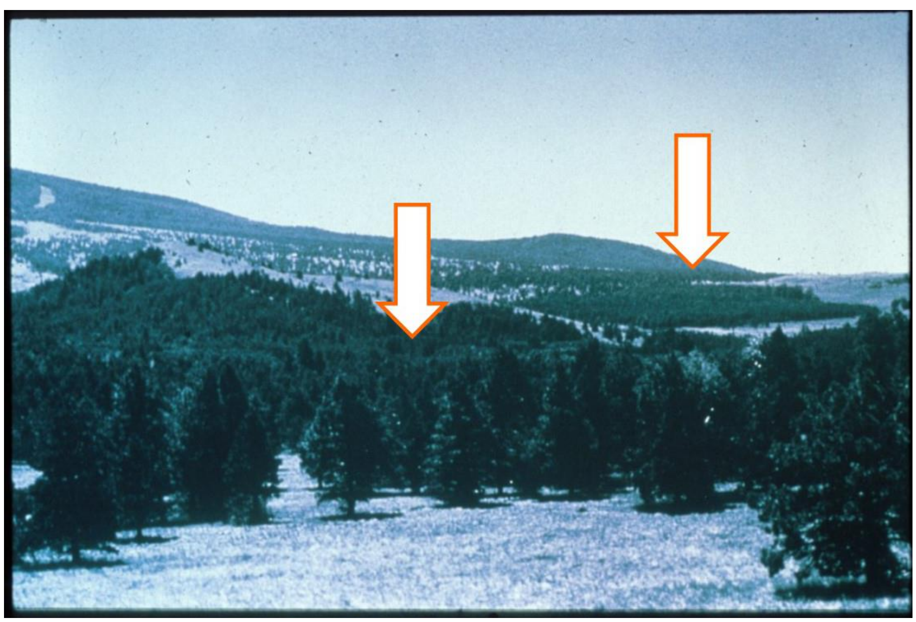
63. *See id.* at 5–6.

Figure 2a



Landscape-scale changes. Hart Prairie, outside of Flagstaff, Arizona, in 1885. Note the openness with pine and aspen in mixed stands.

Figure 2b



Same photo point in 1990. Note the expansion of forest into what was formerly open prairie.

E. Federal Appropriations and the Cost of Fire Suppression

Over the last twenty years the cost of fire suppression has skyrocketed.[64] Unlike other federal agencies that are not required to budget for potential disasters, the U.S. Forest Service is required to fund fire suppression entirely within their annual appropriation (along with all their other management responsibilities).[65] The ability to accurately predict and fund fire suppression and all the other management responsibilities of the U.S. Forest Service changed with the fire season of 2000.[66] According to the GAO, "[t]he scale and intensity of the fires [of 2000] capped a decade that was characterized by dramatic increases not only in the number of severe wildland fires, but also in the costs associated with suppressing them."[67] In 2000, the cost of the wildfire season exceeded the U.S. Forest Service fire suppression budget necessitating the need for emergency supplemental appropriations.[68]

Unfortunately, as fire suppression costs have increased an ever-growing percentage of the U.S. Forest Service budget is consumed by wildland fire management.[69] Wildland fire suppression funding is based on a ten-year rolling average calculated backward over the previous ten years.[70] That approach worked when fire suppression was predictable and stable. However, given the continuing build-up of fuels, changing climatic conditions that result in longer, drier and more severe fire seasons, and more people living in the WUI, suppression activities are more complex and more expensive than in the past.[71] Equally insidious is that the U.S. Forest Service has had to "borrow money" from itself to cover suppression costs resulting in the disruption of other management activities.[72] In 2009 Congress passed the FLAME Act[73] to create a more sustainable funding mechanism in order to stop fire borrowing;[74] however, the act has not been effective, and as a result

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64. *See* U.S. FOREST SERV., THE RISING COST OF WILDFIRE OPERATIONS: EFFECTS ON THE FOREST SERVICE'S NON-FIRE WORK 2 (2015).

65. *Id.* at 3.

66. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-02-259, SEVERE WILDLAND FIRES 1 (2002).

67. *Id.*

68. *See e.g.*, *Regulations and Plans*, FIREWISE COMMUNITIES, http://www.firewise.org/wildfire-preparedness/regulations-and-plans.aspx?sso=0, (last visited Jan. 14, 2016).

69. U.S. FOREST SERV., *supra* note 64, at 2–3.

70. *Id.* at 3.

71. *Id.*

72. *Omnibus Spending Bill Passes*, AM. FOREST RESOURCE CTR. 3 (Jan. 24, 2014), http://www.amforest.org/images/pdfs/AFRC_Newsletter_1-24-14.pdf.

73. FLAME Wildlife Suppression Reserve Funds, 43 U.S.C. § 1748a (2009).

74. *See Regulations and Plans*, *supra* note 68.

numerous bills have been introduced in Congress over the last three years in order to create a better fix.[75]

In 2015, the U.S. Forest Service expects more than fifty percent of its annual budget to go toward suppression of wildfire and related activities.[76] According to the U.S. Forest Service report, *The Rising Cost of Wildfire Operations: Effects on the Forest Service's Non-Fire Work* presented to Congress in 2015:

> Funding for non-fire programs has not kept pace with the increased cost of fighting fire. The growth in fire suppression costs has steadily consumed an ever-increasing portion of the agency's appropriated budget . . . requiring the agency to forego opportunities to complete vital restoration work and meet public expectations for services. Those non-fire activities are often those that improve the health and resilience of our forested landscapes and mitigate the potential for wildland fire in future years.[77]

Ironically, as the cost of fire suppression spiraled upward, the Office of Management and Budget chose in Fiscal Year (FY) 2014 to cut hazardous fuels reduction dollars and focus its attention on fire "cost containment."[78] For years prior to 2014 the OMB and GAO asked the federal land management agencies to demonstrate when and how federal investments in hazardous fuels treatments would result in a reduction in federal suppression costs. Congress reacted by holding hearings in the summer of 2013 to determine if hazardous fuels treatments were effective in reducing both ecological and economic impacts of fire.[79] That summer the Ecological Restoration Institute presented a report addressing OMB's concerns. It demonstrated the efficacy of forest thinning and restoration for changing fire behavior, protecting property and avoiding costs associated with catastrophic fire and its aftermath.[80]

The enduring solution to solving the catastrophic fire crisis is to increase federal investment in restoration treatments and hazardous fuels reduction

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75. *See, e.g.*, Wildfire Disaster Funding Act of 2014, H.R. 3992, 113th Cong. (2014).

76. U.S. FOREST SERV., *supra* note 64, at 2.

77. *Id.* at 3.

78. U.S. DEP'T OF AGRIC., FISCAL YEAR 2014 BUDGET JUSTIFICATION 230 (2013), http://www.fs.fed.us/aboutus/budget/2014/FY2014ForestServiceBudgetJustificationFinal041613.pdf.

79. *See e.g.*, *Oversight Hearing Before the Subcomm. on Pub. Lands & Envtl. Regulation of the Comm. on Nat. Res.*, 113th Cong. 113–32 (2013).

80. *See generally* ECOLOGICAL RESTORATION INST. N. ARIZ. UNIV., FOREST RESTORATION TREATMENTS: THEIR EFFECT ON WILDLAND FIRE SUPPRESSION COSTS (2013), http://openknowledge.nau.edu/1283/1/Fitch_EtAl_2013_ERIWhitePaper_ForestRestorationTreatments.pdf.

activities that prevent unnatural fire by restoring forests. Metaphorically speaking, our current strategy is focused on cutting services in the emergency room rather than investing in keeping the patient well. This strategy may work in the short-term, but ultimately we are likely to lose the "patient."

III. THE ECONOMIC, ECOLOGIC, AND SOCIETAL VALUE OF A HEALTHY FOREST

Conserving forests, and the breadth of environmental services they provide, was a founding motivation for establishing the system of federal forest reserves 100 years ago.[81] However, as society changed, so did the focus of the U.S. Forest Service. For example, rapid economic expansion following World War II led the U.S. Forest Service to increase national timber production to provide wood for a booming home-building industry.[82] As timber production became the central focus of the U.S. Forest Service, managing for other forest-derived services became less important for the public and for policymakers.[83] However, in the 1950s and 1960s, outdoor recreation and other uses of forests intensified as people found they had more leisure time.[84] In response, Congress passed the Multiple Use-Sustained Yield Act of 1960.[85] It authorized and directed the Secretary of Agriculture to develop and administer the renewable resources of national forests, including outdoor recreation, watersheds, wildlife, and other values in such a way that they would be available in perpetuity.[86] It clarified that no single use should take precedence over another.[87] Nevertheless, it wasn't until timber production declined in the 1990s that the U.S. Forest Service began to redefine its mission to reflect current societal preferences.

Over the last ten years the leadership of the U.S. Forest Service has reasserted the importance of healthy forests not because they produce timber, but rather for the wealth of environmental services they provide and for their associated economic and social benefits.[88] This renewed focus on

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81. Collins, *supra* note 61, at 2.

82. *See generally* ROBERT D. BAKER ET AL., TIMELESS HERITAGE: A HISTORY OF THE FOREST SERVICE IN THE SOUTHWEST 57 (1988).

83. Collins, *supra* note 61, at 4.

84. BAKER ET AL., *supra* note 82, at 121.

85. Multiple-Use Sustained-Yield Act of 1960 16 U.S.C. §§ 528–531 (1960).

86. *Id.*

87. *Id.*

88. *See generally* Collins, *supra* note 61, at 7; *The National Forest System and Active Forest Management: Hearing Before the Subcomm. on Conservation & Forestry of the H. Comm. on Agric.*, 114th Cong. (2015) (statement of Tom Tidwell, Chief, U.S. Forest Serv.), http://agriculture.house.gov/uploadedfiles/tidwell_testimony.pdf.

environmental services generated creative thinking about some of the contemporary outputs that can be derived and economically valued from forests, such as carbon sequestration credits for reforestation[89] and water.[90] In Arizona, when full-cost accounting considers the diverse constellation of benefits derived from forests, the economic value of a forest far exceeds the value of its saw timber.[91]

We have much to gain from restoring forests and more to lose if we do not. The most immediate value of a restored forest is the avoidance of the costs and effects of catastrophic fire.[92] A restored forest will provide improved environmental services, jobs during and following restoration, and woody biomass fuel that can be used to offset our energy dependence on oil.[93]

A. Losses Avoided

There are numerous costs associated with large fires that are far greater than just the cost of suppression.[94] Direct costs include loss of timber, loss of property, and the cost of post-fire rehabilitation.[95] Indirect costs include lost wages, mental health issues, and loss of habitat for endangered and threatened species and are much more difficult to quantify.[96] The loss of firefighter and/or civilian lives, such as the devastating loss of nineteen firefighters at the Yarnell Hill fire in 2013, defy any meaningful monetary measurement.[97] A 2003 study determined that the direct cost associated with the 42,875-acre Cerro Grande fire was approximately $1.2 billion, of which only $33.5 million (2.8%) could be attributed to fire suppression costs.[98] The principal

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89. Dan Berman, *Forest Service to Sell Carbon Credits to Fund Reforestation*, GREENWIRE (July 27, 2007), http://rlch.org/news/forest-service-sell-carbon-credits-fund-reforestation.

90. Tina Rosenberg, *Clean Water at No Cost? Just Add Carbon Credits*, N.Y. TIMES (Nov. 15, 2010, 8:45 PM), http://opinionator.blogs.nytimes.com/2010/11/15/clean-water-at-no-cost-just-add-carbon-credits.

91. Tong Wu et al., *Investing in Natural Capital: Using Economic Incentives to Overcome Barriers to Forest Restoration*, 19 RESTORATION ECOLOGY 441, 443 (2011).

92. YEON-SU KIM ET AL., THE EFFICACY OF HAZARDOUS FUEL TREATMENTS 14 (Ecological Restoration Inst. N. Ariz. Univ. ed., 2013), http://library.eri.nau.edu/gsdl/collect/erilibra/index/assoc/D2013004.dir/doc.pdf.

93. Wu et al., *supra* note 91, at 443.

94. *See supra* Box 2.

95. *Id.*

96. *See* DOUGLAS C. MORTON ET AL., ASSESSING THE ENVIRONMENTAL, SOCIAL, AND ECONOMIC IMPACTS OF WILDFIRE 10–37 (2003), http://interwork.sdsu.edu/fire/resources/documents/AssessingWildfireImpacts.pdf.

97. Laura Krantz, *The West's Forest Fire Problem Costs More Every Year*, NEWSWEEK (Feb. 2, 2015, 7:29 AM), http://www.newsweek.com/2015/02/13/wests-forest-fire-problem-cost-more-every-year-303357.html.

98. *See* MORTON ET AL., *supra* note 96, at 17.

impacts of the fire were damage to private property and homes, the Los Alamos National Laboratory, archeological and cultural sites, and watersheds.[99] A more recent study of the full costs of the 2010 Schultz fire and post-fire flood in Flagstaff, Arizona used surveys, assessor's records, and interviews to calculate the full cost of that disaster to be between $133 and $147 million.[100] One cost-avoidance analysis concluded that it is economically irrational not to reduce hazardous fuels.[101] The authors of the analysis argue that the amount that could be invested in treatments to avoid future costs justifies spending $238–$601 per acre for hazardous fuel reduction treatments in the Southwest.[102] An accounting of costs associated with the 469,000-acre Rodeo-Chediski fire of 2002 demonstrates the potential magnitude of some indirect costs.[103] For example, short-term job losses in Navajo and Apache counties and associated lost wages were estimated to be $6.1 million; the mental health needs of those residents living in evacuation shelters were likewise great, requiring more than 4,883 therapy sessions with mental health volunteers and professionals.[104] In addition, more than 3,500 acres of critical endangered species habitat for Mexican spotted owl were lost.[105]

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99. *Id.* at 17–19.

100. THOMAS COMBRINK ET AL., A FULL COST ACCOUNTING OF THE 2010 SCHULTZ FIRE 2 (Tayloe Dubay ed., 2013), http://www.idahoforests.org/img/pdf/FullCostAccounting2010SchultzFire.pdf.

101. *See* Snider et al., *supra* note 44, at 435.

102. *Id.*

103. ARIZ. DEP'T OF HEALTH SERVS., PUBLIC HEALTH ASSESSMENT: RODEO-CHEDISKI FIRE, JUNE 18, 2002–JULY 9, 2002, NAVAJO COUNTY, ARIZONA 5–29 (2002).

104. *Id.* at 18, 25–26.

105. U.S. FISH & WILDLIFE SERV., FINAL RECOVERY PLAN FOR THE MEXICAN SPOTTED OWL (STRIX OCCIDENTALIS LUCIDA) 36 (2012), http://www.biologicaldiversity.org/species/birds/Mexican_spotted_owl/pdfs/MSO_Recovery_Plan_First_Revision.pdf.

Figure 3a

This stand of ponderosa pine had 23 trees per acre in 1876, but there were 1,254 trees per acre, or 28.3 tons of biomass per acre, when this photograph was taken in 1993.

Figure 3b

The same stand four years after thinning to 60 trees per acre. Note the open forest structure and increase in understory vegetative growth.

B. Environmental Services

In the last twenty years, the economic value of extractive products from forests—minerals, timber, and forage for livestock—have lost economic clout to the value of current and potential environmental services provided by a healthy forest.[106] These valuable resources include functioning watersheds and groundwater recharge, wildlife and wildlife habitat, aesthetic and spiritual amenities, and carbon storage, to name only a few.[107] Relying on these resources are the cities and agricultural production of the West, recreation-based rural economies, and highly stressed, amenity-seeking urbanites who go to the woods for renewal.[108]

It is difficult to place a monetary value on the water produced by national forests. A 2010 review of the literature stated that the national forests produce 87 trillion gallons of water per year that supplies more than 60 million people.[109] Calculating the exact value of the water is difficult because the value of water has both market and nonmarket values.[110] Nevertheless, attempts have been made using a variety of approaches. The paper cites one study that conservatively estimates the value at $3.7 billion per year while admitting that some benefits couldn't be calculated.[111]

Another study surveyed more than 600 people to determine their willingness to pay for protecting habitat for the endangered Mexican spotted owl.[112] They found that the range of estimated value of those surveyed when extrapolated for the entire country was from $1.8 to $2.6 billion.[113] This figure was significantly larger than cost estimates for implementing the species recovery plan and demonstrates the importance of wildlife and wildlife habitat to the public.[114]

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106. *See* TODD A. MORGAN ET AL., THE FOUR CORNERS TIMBER HARVEST AND FOREST PRODUCTS INDUSTRY 2 (2002) (noting that due to environmental considerations, timber harvest levels have greatly decreased in Arizona); J.E. DE STEIGUER ET AL., SOCIOECONOMIC ASSESSMENT OF THE NATIONAL FORESTS IN ARIZONA 13–18 (2005) (observing that extractive uses have shifted away in favor of recreational uses and restoration).

107. *See* ALISON BERRY, SONORAN INST., LITERATURE REVIEW: THE ECONOMIC VALUE OF WATER AND WATERSHEDS ON NATIONAL FOREST LANDS IN THE UNITED STATES 2–3 (2010) (detailing the value of watersheds, groundwater recharge, and other benefits); Wu et al., *supra* note 91, at 443 (detailing forests as carbon storage).

108. *See* DE STEIGUER ET AL., *supra* note 106, at 13–18.

109. BERRY, *supra* note 107, at 1.

110. *Id.* at 2–3.

111. *Id.* at 3.

112. John Loomis & Earl Ekstrand, *Economic Benefits of Critical Habitat for the Mexican Spotted Owl: A Scope Test Using a Multiple-Bounded Contingent Valuation Survey*, 22 J. AGRIC. & RESOURCE ECON. 356, 361–62 (1997).

113. *Id.* at 364.

114. *Id.* at 364–65.

C. Jobs and Business

According to testimony provided by U.S. Forest Service Chief Tom Tidwell, in FY 2011, activities on the national forests contributed more than $36 billion to America's gross domestic product and supported nearly 450,000 jobs.[115]

Forest restoration provides the opportunity to create jobs in the harvest and manufacturing sector that pay competitive wages.[116] Although tourism contributes significantly to the economies of the Rocky Mountain West, it is an employment sector that relies heavily on an unskilled, low-paid work force.[117] As forest restoration activities ramp up to reduce hazardous fuels, many hope there will be new opportunities for creating a restoration-based economy. One vision for restoration-based, private sector businesses is that they will be diverse and appropriately scaled to the amount of wood by-products generated by restoration.[118] This model seeks to avoid the problems created by previous boom-and-bust economic cycles that led to political pressure on forest managers to generate wood for the sake of industry at levels inconsistent with sustainable forest management.[119]

Private sector investment in businesses using small wood has been weak during the last fifteen years because investors lack confidence in business plans that depend on wood supply from federal lands.[120] To address this problem, Congress, in 1998, created a new contracting tool for the U.S. Forest Service.[121] Commonly referred to as "stewardship contracting,"[122] this instrument has proven to be very useful for achieving restoration goals and helping rural communities.[123] Stewardship contracting enables agency decision makers to award contracts on the basis of "best value contracting," which allows price and non-price criteria to be considered in the bid, multiple-year wood supply guarantees, and the ability to mix and match payment for services in combination with timber sales.[124]

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115. *The National Forest System and Active Forest Management*, *supra* note 88, at 2 (statement of Tom Tidwell, Chief, U.S. Forest Serv.).

116. *See* Wu et al., *supra* note 91, at 443.

117. *See* DE STEIGUER ET AL., *supra* note 106, at 7–9.

118. *See* Wu et al., *supra* note 91, at 443.

119. *See id.*

120. MATER ENG'G, LTD., WRAP-UP AND IMPLEMENTATION REPORT: RESTORATION RESOURCES AND INVESTMENT POTENTIAL 3–6 (2002).

121. CAROL DALY ET AL., ECOLOGICAL RESTORATION INST. N. ARIZ. UNIV., FOREST SERVICE CONTRACTING: A BASIC GUIDE FOR RESTORATION PRACTITIONERS 7 (Dave Egan ed., 2006).

122. Stewardship End Result Contracting Act, Pub. L. No. 108-7, § 323, 117 Stat. 275 (2003).

123. *See* DALY ET AL., *supra* note 121, at 7.

124. *Id.* at 7–8.

The White Mountain Stewardship Contract (WMSC) in eastern Arizona illustrates the potential for the growth of private sector business and job creation when a guaranteed wood supply is made available.[125] Begun in 2004 and completed in 2014 the WMSC treated almost 70,000 acres over ten years and stimulated the creation of twenty diverse businesses in the wood harvest and manufacturing sector during the first five years.[126]

CONCLUSION

The consensus among natural resource professionals and ecologists is that disruption of natural fire regimes, dramatic increases in tree populations, and spreading landscape homogeneity are the greatest single threat to biological diversity and ecosystem sustainability in the Rocky Mountain West, and that actions must be taken to reverse ongoing ecosystem degradation. Without such coordinated action at the landscape scale, the prospects look grim for the quality of life—not only for the forest and woodland ecosystems of the Rocky Mountain West, but for the human populations that rely on these resources.

Forest restoration provides important monetary and non-monetary values that improve prospects for community and forest health. We can clearly demonstrate that it is economically smart and practical to invest federal funding in treatments that will reduce the risk of fire and avoid the need to suppress them. Forest restoration has the potential to stimulate new markets for wood products and produce energy that simultaneously will create new business opportunities and good paying jobs. In addition, the environmental services provided by forests, although difficult to fully quantify, are essential for future economic development and societal well-being.

Fortunately, the public is aware of the problems associated with degraded forest health and support region-wide ecological treatments designed to restore the regions' forests. Controversy can be minimized and progress made by identifying the areas of broad agreement for restoration action through collaboration among diverse stakeholders. After many years of confounded land management, we are testing a more inclusive approach to forest management. Fortunately, this new paradigm is advancing the actions needed to restore the forests of the Rocky Mountain West.

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125. *See* SUZANNE SITKO & SARAH HURTEAU, NATURE CONSERVANCY, EVALUATING THE IMPACTS OF FOREST TREATMENTS: THE FIRST FIVE YEARS OF THE WHITE MOUNTAIN STEWARDSHIP PROJECT iv–vii (2010).

126. *See id.* at vi–vii; Jim Zornes, *San Juan Fire is Proof: Forest Thinning Works*, AZ CENT. (July 25, 2014, 4:16 PM), http://www.azcentral.com/story/opinion/op-ed/2014/07/25/san-juan-fire-forest-thinning/13156411.