COMMUNITY WILDFIRE PROTECTION PLAN

for Flagstaff and Surrounding Communities in the Coconino and Kaibab National Forests of Coconino County, Arizona

October 2004

A collaborative planning and implementation effort coordinated by:

Greater Flagstaff Forests Partnership
&
Ponderosa Fire Advisory Council

Community Wildfire Protection Plan for Flagstaff and Surrounding Communities in the Coconino and Kaibab National Forests of Coconino County, Arizona

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SIGNATURE PAGE

Prepared and Submitted by: ***(for the CWPP Development Team)***

_____

Steve Gatewood, Program Director – GFFP DATE

_____

Paul Summerfelt, Member – PFAC DATE

Concurrence by:

_____

Debra Larson, Chair – GFFP DATE

_____

Nora Rasure, Supervisor – Coconino National Forest DATE

_____

Palma Wilson, Superintendent – Flagstaff Area National Monuments, National Park Service DATE

Approved by:

_____

Joseph Donaldson, Mayor – City of Flagstaff DATE

_____

Deborah Hill, Chairman – Coconino County Board of Supervisors DATE

_____

Don Howard, Chair – PFAC (Representing Fire Departments & Fire Districts) DATE

_____

Kirk Rowdabaugh –State Forester Arizona State Land Department DATE

Introduction

Context: Wildfire is a natural event within the southwestern ponderosa pine forest. Its very occurrence is a necessary ingredient to a healthy ecosystem. However, historic fires were predominantly frequent surface fires of low intensity that thinned the forest of fuel accumulations, with occasional intense stand replacement fires occurring in patchy areas or under extreme fire conditions. Due to past societal demands and land-management practices, natural fuel accumulations have been increasing for decades, resulting in an escalating trend in uncharacteristic, dangerous, destructive, and costly wildfires.

When a forest is "healthy" it would support low intensity, ground fires every 2-20 years across the landscape. Every year hundreds of thousands of acres of surface fuels would burn through natural ignitions or ignitions by native (pre-European) peoples. Thus, one of the best defenses against "catastrophic crown fires" is to live with and adapt to the type of fire that is natural to the system. As the one of the goals of the national fire plan states, a "Community-based approach to wildland fire issues combines cost-effective fire preparedness and suppression to protect communities and the environment with a proactive approach that recognizes fire as part of a healthy, sustainable ecosystem."

The 1996 fire season in our area clearly focused public attention on the plight of our forests and the risk posed by catastrophic wildfire. The result was an energized community committed to action, the founding of the Greater Flagstaff Forests Partnership (GFFP), and the increased involvement of the Ponderosa Fire Advisory Council (PFAC). Since that time, continued wildfire activity and on-going education and mitigation efforts have resulted in widespread public support of and an expectation for forest treatments. In addition, as we become more effective with our treatments, land managers will be able to make greater use of characteristic, low intensity fires through prescribed burns, appropriate wildland fires for resource benefit and containment of wildland fires as more effective, cost efficient strategies – a true measure of living with and adapting to a fire-dependent ecosystem.

Community protection and preparedness is a critical step toward mitigating immediate fire hazards and restoring adjacent wildlands. A combination of fuel management, FireWise standards, and appropriate fire-use and/or suppression response across ownerships within-and-adjacent to at-risk communities will reduce threats to life and property, protect values-at-risk, and create a safe context for the use of fire in subsequent forest ecosystem restoration efforts. This plan outlines actions needed to prepare and equip the greater Flagstaff community to live and thrive within our fire-adapted ponderosa pine forests.

<u>Goal:</u> *To protect Flagstaff and surrounding communities, and associated values and infrastructure, from catastrophic wildfire by means of:*

a) An educated and involved public,

b) Implementation of forest treatment projects designed to reduce wildfire threat and improve long-term forest health, in a progressive and prioritized manner, and

c) Utilization of FireWise building techniques and principles.

The Community Wildfire Protection Plan (CWPP), authorized by the Healthy Forests Restoration Act of 2003, is a strategic plan as well as an action plan: it provides a broad operating framework for all agencies and ownerships – private, city, county, state, and federal – within the area, while identifying community protection priorities. Site specific planning and implementation remains the responsibility of each owner/jurisdictional agency, acting in concert with the guidelines expressed within this plan.

Photo 1: Volunteers preparing a future prescribed fire site

Photo 2: A treated forest

Photo 3: A FireWise Home

Fuel management treatments designed to reduce the threat of catastrophic wildfire and protect communities incorporate the principles of ecological restoration. Practices designed to reduce excessive numbers of smaller trees, retain large trees, and accept natural fire (or apply prescribed fire to mimic the natural event) are key to reducing the wildfire threat in our area. These treatments, along with other practices over a period of time, are required to create the conditions necessary for an improvement in overall forest ecosystem health.

Partners: PFAC is a 16 member group of local emergency and prevention fire agencies; GFFP is a 27 member group committed to ecological forest restoration and community wildfire protection. Membership for each organization is included in Appendix 1. Both groups have partnered to coordinate development of this plan. Staff of the Coconino National Forest (USFS), which is a member of PFAC and operates under a Memorandum of Understanding with GFFP, have been consulted throughout this process as well.

Both PFAC and GFFP, in concert with strong citizen support, have been collaborating for years to reduce the risk of wildfire. Traditionally, PFAC has focused on response to fire events and public education designed to lessen the risk, while GFFP has designed forest restoration and community protection projects in 10,000-acre blocks around the greater Flagstaff area.

Signed by President Bush in December 2003, the Healthy Forest Restoration Act (HFRA) requires development and approval of a CWPP by communities who wish to receive priority funding for implementation of forest treatments designed to reduce wildfire risks to their respective community.

The GFFP and PFAC have identified five mutual objectives: though not all are specifically referenced or included in the CWPP, they nonetheless influenced plan development. They are:

- Create a healthy and sustainable forest and protect communities by implementing forest treatments designed to reduce the threat of catastrophic wildfire.

- Engage the public by providing opportunities in both preparedness and mitigation efforts.
- Support efforts to establish effective and sustainable methods to utilize small-diameter wood and other forest biomass.
- Promote FireWise building materials and construction techniques, as well as creation and maintenance of defensible properties and neighborhoods.
- Attract necessary funding (appropriations, contracts, donations, grants, etc.) to successfully reduce fire threat.

Both groups take seriously their respective responsibility to resolve the issues we – as a greater community – now face. Together, we are committed to action that will reduce wildfire threat across jurisdictions and within our mutual area-of-interest.

The Northern Arizona University Forest Ecosystem Restoration Analysis (ForestERA) project was engaged to provide baseline data and analysis to assess the impacts of ponderosa pine restoration and fuel-reduction treatments. Using the latest available data (2001 satellite imagery), spatial analysis tools in an ArcGIS environment were used to:

- Identify areas for management focus,
- Provide baseline data on current conditions (vegetation, canopy closure, etc.),
- Design treatment scenarios and test and compare the cumulative effects of these modeled treatments on fire behavior, and
- Predict fire hazard and behavior across the entire *Analysis Area.*

NOTE: Interested parties are invited to visit the ForestERA website (www.forestera.nau.edu) for a more detailed discussion of available data and their modeling process.

It is recognized this is a "coarse-filter" approach restricted to ponderosa pine forest ecosystems that does not exactly match what various agencies would utilize to plan and implement site-specific treatments. Therefore, information presented throughout this plan can and should be augmented by the Jurisdiction-Having-Authority (JHA) with site-specific data during project planning efforts. This may result in adjustments of priorities, locations, and treatments.

The inclusion, application and analysis of ForestERA data is intended to provide a framework for discussion and illustrate both the threat and potential impacts of a range of treatments that could be applied throughout both the *Wildland/Urban Interface* zone and the entire *Analysis Area.*

Principles: Development of the CWPP has been guided by the following framework:

- *Fuel Management:* Reduction of target hazardous fuels is based upon known fire risk, fire behavior, and threats to values-at-risk.
- *Social and Political.* Social and political concerns play a major part in defining treatments and their locations.

- *Operational:* Due to financial, infrastructure, and personnel constraints, emphasis must placed on strategically located fuel treatments designed to protect key values-at-risk, and that can serve as anchor points for larger, landscape-scale treatments.
- *Ecosystem:* Reduction of hazardous fuels should be integrated with overall ecosystem conservation, restoration and management goals.
- *Economic:* Implementation and maintenance of fuel treatment benefits greatly outweigh their costs -

    - They save money by avoiding suppression expenditures, rehabilitation costs, and compensation for property damage
    - They are an investment in protecting firefighter and civilian lives
    - They present new opportunities for rural economic development
    - They may help address issues related to the availability of homeowner's insurance in fire prone forest ecosystems

- *Ethical:* The continuing decline in forest health and the increasing probability of catastrophic fires, and their potential impact on the greater Flagstaff region, is a reality. The need to act now to restore forest health and reverse this dangerous downward spiral is of utmost importance.

In addition, the Arizona Governor's Forest Health Advisory Council developed a set of *"Guiding Principles for Forest Restoration and Community Protection"* through collaboration by a wide variety of forest professionals to help communities think through how to articulate a plan of action for restoring their forests, and for protecting their communities. Those Principles are included as Appendix 2 and were used during development of this plan and in the design of actions to achieve our goal.

Process: Development of the CWPP incorporated the eight steps outlined in *"Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities"* (March 2004). These steps are:

- **Step One:** Convene decision makers
- **Step Two:** Involve federal agencies
- **Step Three:** Engage interested parties
- **Step Four:** Establish a community base map
- **Step Five:** Develop a community risk assessment
- **Step Six**: Establish community hazard reduction priorities and recommendations to reduce structural ignitability
- **Step Seven:** Develop an action plan and assessment strategy
- **Step Eight:** Finalize the Community Wildfire Protection Plan

In addition, we endeavored to reflect the standard themes of any emergency plan – Prevention, Mitigation, Response, and Recovery – where appropriate in the plan.

To facilitate development of the CWPP, both PFAC and GFFP, operating together, initiated the following:

---

1) Issued a press release outlining the effort and offering the public opportunities to become involved and offer comment (CWPP Project Record).

2) Split development of the five sections into separate work groups, with on-going consultation with the USFS.

3) Conducted regular outreach to the community via:

   a) Posting of Development Team meetings in the *AZ Daily Sun*

   b) Informational insert in the July 4th and July 11th edition of the *AZ Daily Sun* – 13,000 copies each day

   c) Article in the summer edition of *CityScape* – 34,000 copies

   d) Article in newsletters:
      (1) Summit Fire District – 3,200 copies
      (2) Continental Home Owner Association (HOA) – 2,400 copies

   e) E-Mail posting to employees– announcement of CWPP planning effort:
      (1) City of Flagstaff – 600 addresses
      (2) Coconino County – 750 addresses

   f) Meetings/Programs/Presentations:
      (1) GFFP *Community Forest Forum* – June 1
      (2) Flagstaff Mayor's Community Leadership Group – June 15
      (3) Community Open-House (Flagstaff) – June 16
      (4) Coconino County Board of Supervisors (Flagstaff) – July 13
      (5) Power-point overview provided to all City of Flagstaff employees - July
      (6) Sedona Fire District Board of Directors (Sedona) – July 27
      (7) Highlands Fire District Board of Directors (Kachina Village) – Aug 11
      (8) Pinewood Fire District Open House (Munds Park) – Aug 21
      (9) Joint session Flagstaff City Council and Coconino County Board of Supervisors – Sept 13
      (10) Kachina Village Open Space event – Sept 25
      (11) Parks-Bellemont Fire District Public Meeting (Parks) – Sept 30

   g) Periodic updates in City of Flagstaff Weekly Report

4) Met with 20 members of the *Communities Committee* (developers of *"Preparing a Community Wildfire Protection Plan*") on Apr 30th

5) Drafts of individual sections were reviewed, edited, and compiled into a working draft CWPP document.

6) Monthly status updates were provided at both the PFAC and GFFP Partnership Advisory Board meetings

7) All members of PFAC and GFFP, along with the public, were afforded an opportunity to provide comment on the working draft

7) A Final Draft was then prepared and distributed, followed by a formal 45-day public comment period. Nine formal comments were received, with most items incorporated into the Final Plan

8) Finally, the CWPP:

   (a) Received **Concurrence** by the GFFP, PFAC, the Coconino National Forest and the National Park Service

   (b) Was **Approved** by the Coconino County Board of Supervisors, Flagstaff City Council, local Fire Departments and Fire Districts, and the AZ State Land Department – Fire Management Division

Coordination occurred with both the Kaibab National Forest and the Williams Interagency Fire Advisory Council regarding areas both west and northwest of this CWPP area, and will continue as they work toward development of a CWPP in their area. Other adjacent areas, such as the Blue Ridge area, will be monitored and coordination will occur as they begin development of CWPPs or are added to this plan by amendment. In addition, the CWPP for Flagstaff and surrounding communities will be reviewed in six months and then annually by a CWPP Review Team consisting of representatives of PFAC, GFFP, the USFS, local governments, environmental groups and citizens. If substantive changes are required, it will be submitted to the appropriate authorities for review and approval.

Relationship To Other Plans: In March 2000, the then Grand Canyon Forests Partnership (GCFP), later renamed the GFFP, in partnership with PFAC, developed a "*Flagstaff Area Wildfire Risk Assessment"* report. That report detailed wildfire risk in the greater Flagstaff area generally based upon a ½-1 mile set-distance from selected communities within the boundaries of the GCFP. This CWPP supercedes that earlier document: we have expanded the analysis area, incorporated additional communities, and utilized data not available at the time of the earlier report to develop a more realistic picture of both threat and need.

This plan is compatible with and inclusive of on-going planning and implementation efforts of various agencies and jurisdictions engaged in its development. In addition, this plan is designed to compliment both existing and developing emergency/disaster management plans and Homeland Security related efforts.

For More Information: This plan is posted on the GFFP website at www.gffp.org. Individuals interested in learning more are encouraged to contact either PFAC or GFFP via email at fuelmanagement@ci.flagstaff.az.usor info@gffp.org, respectively.

Community Identification and Description

Analysis Area: Map 1 depicts Flagstaff and surrounding communities at-risk included in the CWPP *Analysis Area*. The *Analysis Area* includes portions of two counties (primarily Coconino, with a very small part of Yavapai), two cities and their associated adjacent areas (Flagstaff and Sedona), several unincorporated communities (Munds Park, Mormon Lake, Parks/Bellemont, Cosnino/Winona), the greater Flagstaff Metropolitan Planning Organization area (joint County-City of Flagstaff planning effort), two National Forests (primarily the Coconino, with a small part of the Kaibab), and the Flagstaff-area National Monuments.

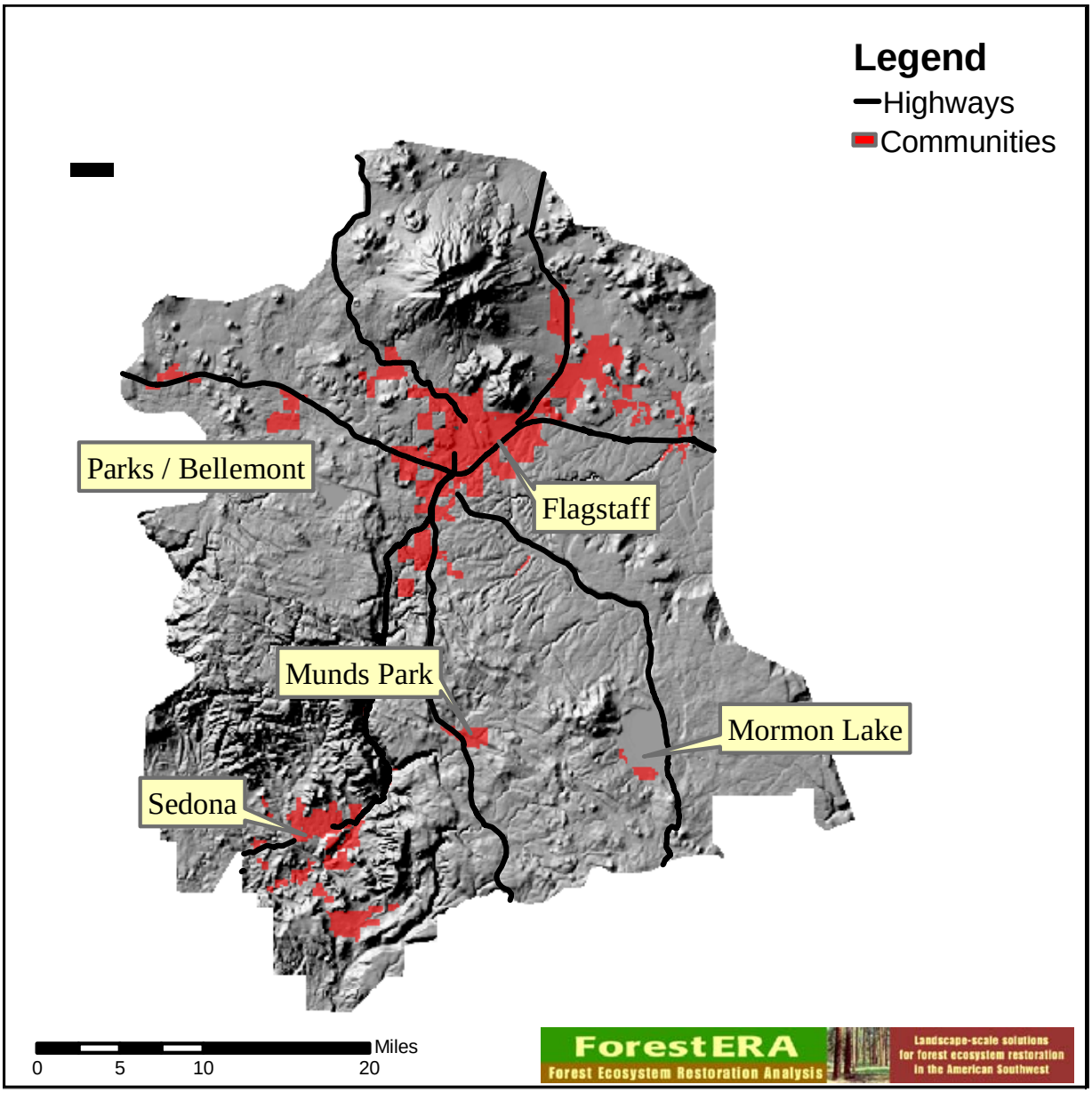
Map 2 depicts ownership within the plan boundary. Acreage breakouts for the *Analysis Area* are shown below:

Table 1
Ownership/Jurisdiction – *Analysis Area*

Ownership/Jurisdiction	Acres	% of Total
Federal:		
Flagstaff Monuments	4,832	.5%
Coconino National Forest	763,064	81.0%
Kaibab National Forest	28,619	3.0%
State:		
Land Department	34,575	3.5%
Camp Navajo (Division of Military & Emergency Affairs)	26,371	3.0%
Private/Other (includes local government)	82,275	9.0%
TOTAL	**939,736**	**100%**

The roughly 1,465-square mile *Analysis Area* stretches from the San Francisco Peaks to below the Mogollon Rim, and is in the midst of the largest continuous ponderosa pine forest in the world. The full-time population of the area is approximately 75,000, with another 20,000+/- visitors in the area on any given day.

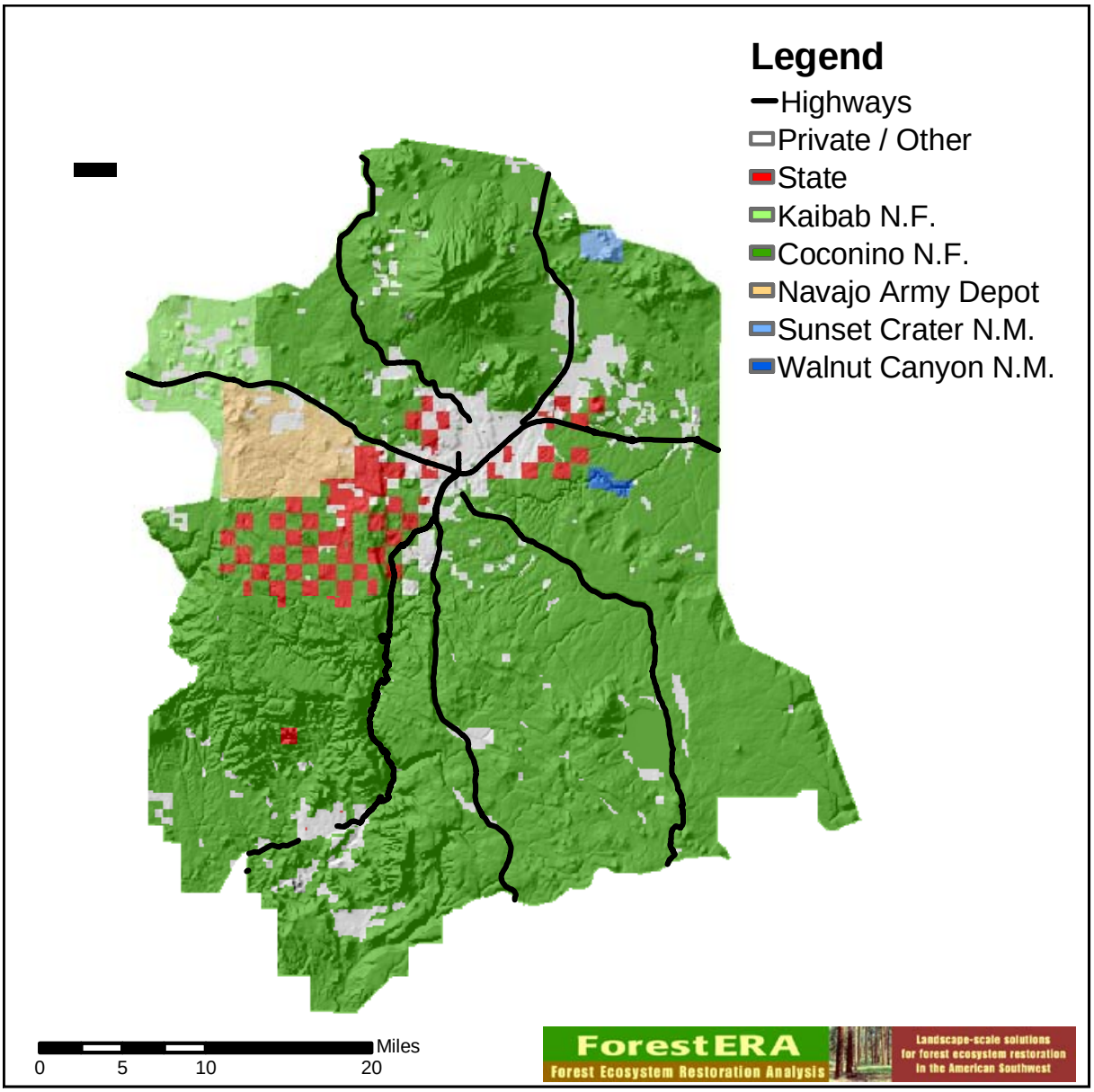
MAP 1



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

ANALYSIS AREA – COMMUNITIES

MAP 2



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

ANALYSIS AREA – LAND OWNERSHIP

In addition, the plan encompasses an area that includes two Interstate Highways (I-17 and I-40), two Arizona Department of Transportation designated scenic byways (Hwy 89A and Hwy 180), a major east-west railroad line (Burlington Northern Santa Fe), a regional airport, a state University and community college, two world-class observatories (three sites), numerous cultural attractions, archaeological treasures, and recreational sites, three critical community watersheds (Flagstaff – Rio de Flag and Lake Mary; Sedona – Oak Creek), and the San Francisco Peaks, the highest mountains in Arizona and a backdrop for the area recognized as a significant site for several Native American tribes.

Headquarters of the Coconino National Forest, the area also serves as the gateway to Grand Canyon National Park. Finally the area is bounded on the west by Camp Navajo, a weapons storage site and AZ Army National Guard training facility, and on the northeast and east by the Flagstaff Area National Monuments (Wupatki, Sunset Crater, and Walnut Canyon).

To facilitate establishment of the *Wildland/Urban Interface*, a Threat Matrix utilizing ForestERA data for the entire *Analysis Area* was developed. Multiple parameters were examined both separately and in combination with others. Those selected to include in the final analysis were as follows:

Table 2
Threat Matrix

VALUES	1. Communities 2. Municipal Watersheds (Lake Mary)
RISK	3. Fire Behavior (Predicted active and passive crown fire, surface fire) 4. Post-Fire Flooding Potential (Rio de Flag and Oak Creek)
OTHER	5. Areas upwind (six-mile distance) <u>from</u> at-risk communities

Items which influenced the selection of these five parameters included:

1. Homes and businesses are the basis of the CWPP. We chose a minimum "buffer" value of a 1½ miles around at-risk communities. (Infrastructure was considered separately – see p. 21)
2. The Lake Mary watershed provides approximately 30% of the water supply for the Flagstaff area (since 1949).
3. Predicted fire behavior (Table 3 and Map 3) can be modeled based upon vegetation, slope, weather and other factors.
4. Both the Rio de Flag and Oak Creek have a high potential for flooding (with associated erosion and sedimentation) following a severe wildfire, with significant impacts to Flagstaff and Sedona, respectively.
5. Large fires are typically associated with wind events: it is not uncommon for long-distance spread of several miles to occur in a relatively short period (4-6 hours).

Table 3
Predicted Pre-Treatment Fire Behavior
Analysis Area

Type Fire Behavior	Acres	% of Total
Active	219,181	23.5%
Passive	420,282	43.5%
Surface	99,207	10.5%
No Prediction	201,066	21.5%
TOTAL	**939,736**	**100%**

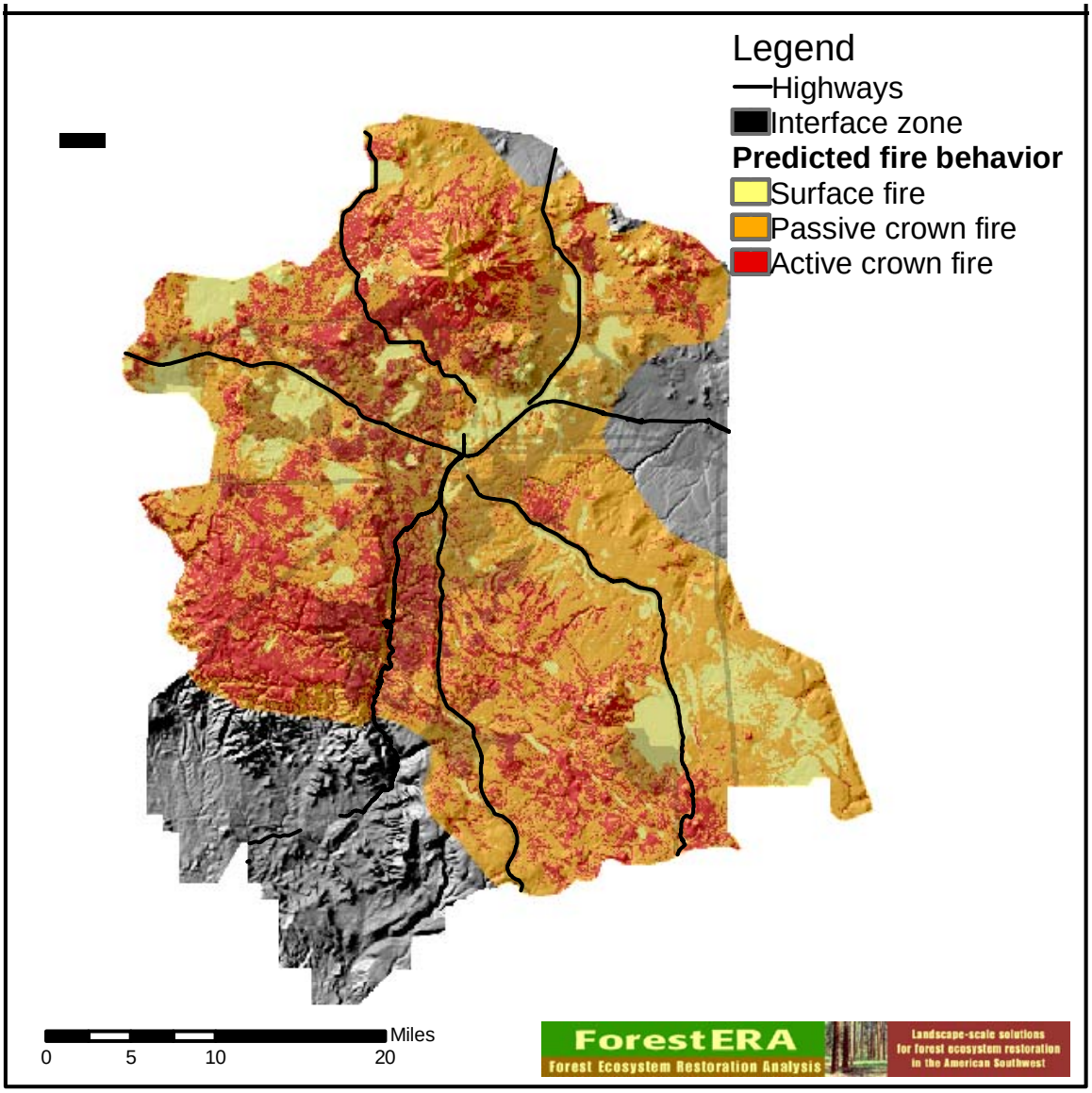
Active Fire Behavior = Fires readily transition into tree crowns and actively moves through the canopy, with large group tree torching common: associated long-range (≥ .5 mile) spotting is common

Passive Fire Behavior = Fires will transition into tree crowns, but does not move through the canopy and only small-group or individual tree torching common: associated long-range spotting (≥ .5 miles) can occur

Surface Fire Behavior = Fires stay on the ground, with little tendency to transition into tree crowns except in isolated cases: short-range spotting (≤ ¼ mile) can occur

No Prediction = No data were available in the ForestERA format that allowed a fire behavior prediction to be made

MAP 3



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

ANALYSIS AREA - PREDICTED FIRE BEHAVIOR, CURRENT CONDITIONS

As depicted in Tables 4 and 5, and Map 4, the Threat Level was divided into three categories: High, Moderate, and Low. Three important items to understand in reviewing this Map are:

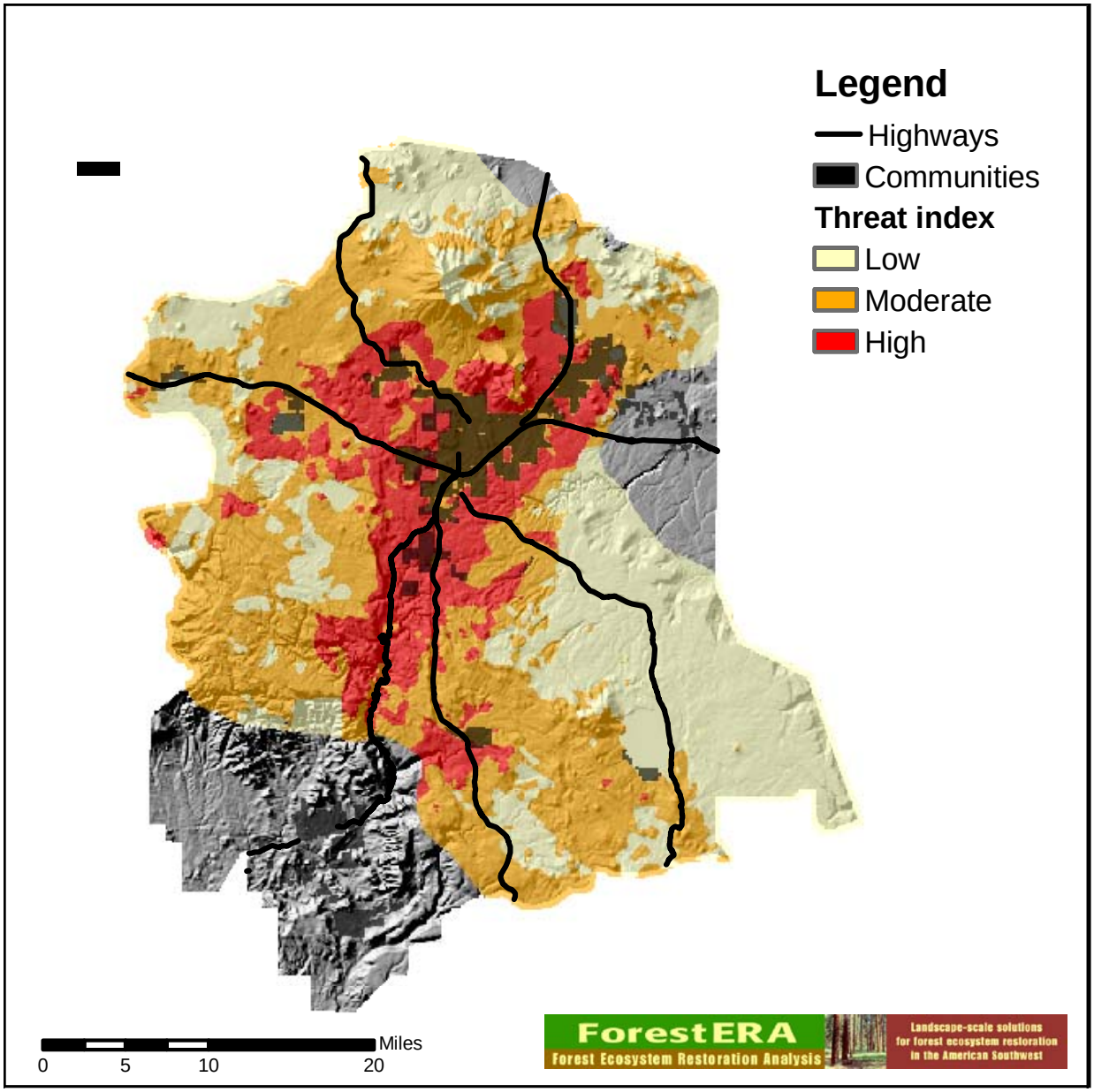
1. Based upon this analysis, an indication of High Threat did not appear around the communities of Parks or Mormon Lake. However, a ground assessment of the site reveals that a High Threat does indeed exist. (This reinforces the concept that the ForestERA approach requires site-specific evaluation prior to implementation of any recommended treatment.) To ensure inclusion of protection for all communities, a 1½ mile buffer on the upwind side of communities and a ½ mile buffer on the downwind side was included.
2. Oak Creek Canyon is a "corridor" which links the Sedona area with both the Munds Park and greater Flagstaff areas. Topography and other resource issues may restrict the ability to conduct large-scale treatments in this corridor, but reinforces the need to implement effective FireWise building standards on private property, and to conduct treatments downwind, where fire will exit the canyon and threaten either Munds Park or Flagstaff.
3. This analysis is based upon a landscape-scale study: threats to some areas (Sedona, Winona, City of Flagstaff) are not clearly depicted but all threat levels are known to exist. Site-specific interpretation is required by local experts, owners, and jurisdictional agencies.

Appendix 2 contains a complete set of the five separate maps listed above (Values, Risk, Other) that were utilized to conduct this analysis.

Table 4
Threat Level Acreage
Analysis Area

Threat Level	Acres	% of Total
High	135,041	14.5%
Moderate	355,192	38.0%
Low	279,243	30.0%
Data Unavailable	170,260	17.5%
TOTAL	**939,736**	**100%**

MAP 4



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

ANALYSIS AREA - THREAT LEVEL

Acreage for each Threat Level by Ownership/Jurisdiction within the entire *Analysis Area* is shown below:

Table 5
Threat Level Acreage by Ownership/Jurisdiction
Analysis Area

	THREAT LEAVEL			
Ownership/Jurisdiction	**High**	**Moderate**	**Low**	**TOTAL**
Federal:				
Flagstaff area Monuments (NPS)	0	94	3,888	3,982
Coconino National Forest	109,652	274,701	235,401	619,754
Kaibab National Forest	355	13,657	14,559	28,571
State:				
Land Department	6,687	13,933	6,687	27,307
Camp Navajo (Division of Military and Emergency Affairs)	8,523	11,391	6,346	26,260
Private/Other (includes local government)	9,824	41,416	12,362	63,602
TOTAL	**135,041**	**355,192**	**279,243**	**769,476**

Wildland/Urban Interface: The *Wildland/Urban Interface* for Flagstaff and surrounding communities at-risk encompasses multiple jurisdictions and ownerships within a relatively large geographical area. It extends for some distance outside the City of Flagstaff corporate boundaries, the largest metropolitan community in Northern Arizona. Areas within unincorporated Coconino County include the communities of Munds Park, Kachina Village, Mountainaire, Forest Highlands, Mormon Lake, Bellemont, Timberline-Fernwood, Doney Park, Lower Lake Mary, Flagstaff Ranch, the Baderville-Ft. Valley, Mt Elden, Westwood, and Pine Dell Fire Districts (contract entities served by the Flagstaff Fire Department), Cosnino, Winona, Upper Oak Creek Canyon, and Sedona, as well as substantial state and federal land. Overall, this plan incorporates these at-risk communities and their associated infrastructure sites into a single regional CWPP, rather than separate plans for each.

The "interface" is often defined as an easily identified geographic area where structures directly abut wildland fuels. In this perspective, the "interface" is confined to a relatively narrow area a set-distance from neighborhoods or communities. Some view it strictly as the "Home Ignition Zone", a distance of roughly 100-200 ft. from a structure. Others view it in a somewhat larger context: the Healthy Forests Restoration Act (HFRA) identifies it, in the absence of a CWPP, as a distance of ½ mile or 1½ mile from an at-risk community, depending on local conditions.

Limiting treatments to a pre-set distance from structures, while important to individual structure and/or infrastructure protection, does not recognize that a community is more than a collection of structures, and fails to understand the dynamic nature of fire behavior. Further, a strict distance definition does not adequately address the ecological needs of an area.

The *Wildland/Urban Interface* for Flagstaff and surrounding communities, as allowed by the HFRA, is identified as an area where public safety is the over-riding goal: it is sufficiently large to:

1) Reduce the potential of a high intensity fire from entering the community,
2) Create an area whereby fire suppression efforts will be successful,
3) Limit large amounts of wind-driven embers or "fire brands" from settling on the community, and
4) Protect critical infrastructure.

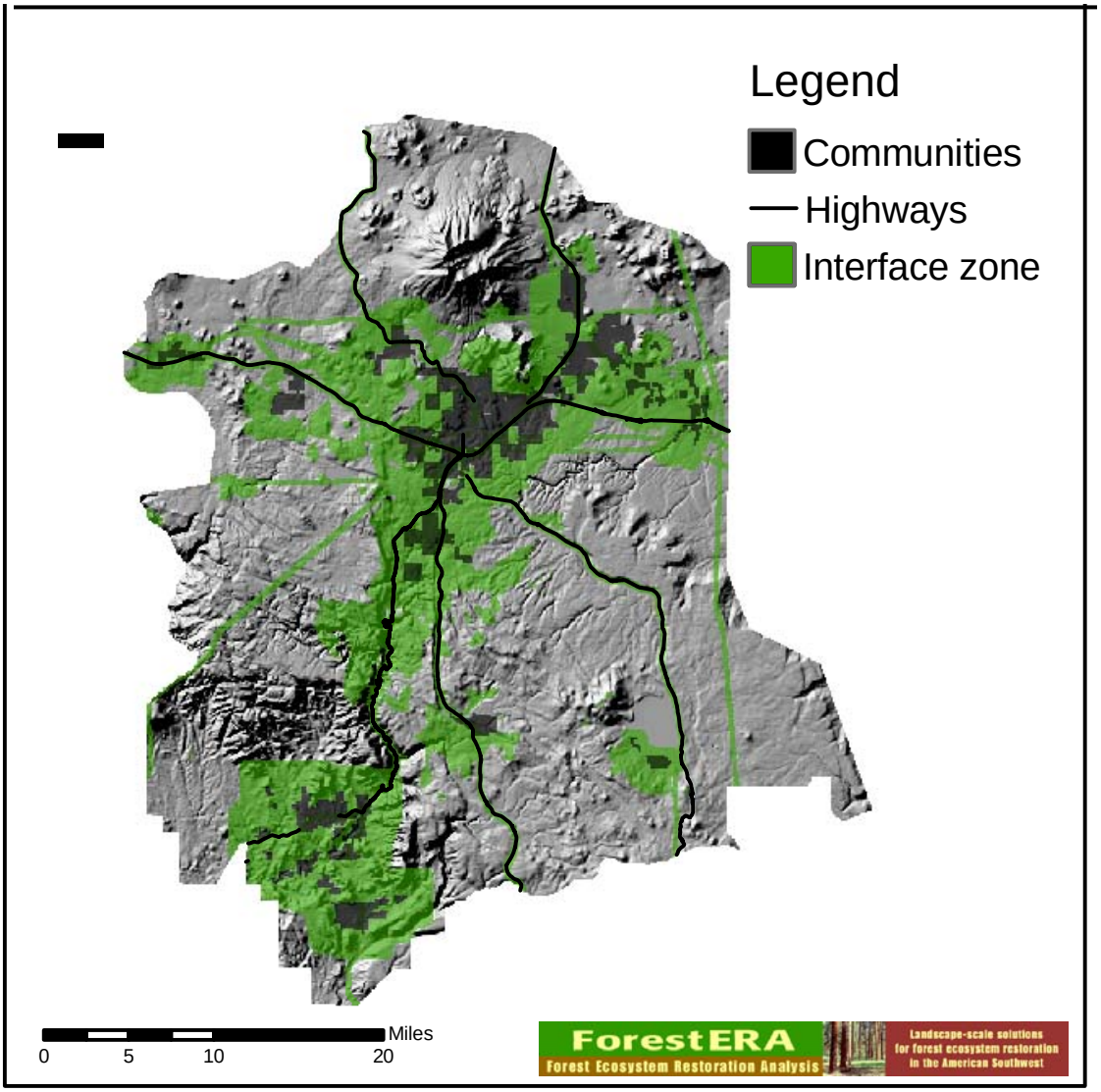
Infrastructure outside of identified at-risk communities was also incorporated into the *Wildland/Urban Interface* zone. We chose to buffer infrastructure, such as is listed below, by a ¼ mile treatment zone (1/8 mile either side):

- NOPI Research Facility – Anderson Mesa
- Utilities: High voltage overhead powerlines
  El Paso Natural Gas aboveground stations
- Transportation Burlington Northern Santa Fe Railroad
  Interstate 17 and 40
  State Highways 3, 89A, and 180
- Communication: Cell Phone Towers
  Mt. Elden Tower Sites
  Mormon Mountain Tower Sites
  Schnebly Hill Tower Sites

In addition, ForestERA data does not exist for the Sedona and Cosnino/Winona areas. We have therefore chosen to include a 1½ mile buffer on the upwind side of each community and a ½ mile buffer on the downwind side.

When the Threat Map (Map 4, p.18) and community and infrastructure buffers were combined, the *Wildland/Urban Interface* for this CWPP was established as depicted on Map 5, with acreage breakouts shown in Table 6.

MAP 5



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

WILDLAND/URBAN INTERFACE ZONE

Table 6
Ownership/Jurisdiction – *Wildland/Urban Interface* zone

Ownership/Jurisdiction	Acres	% of Total
Federal:		
Flagstaff Monuments	146	.1%
Coconino National Forest	215,166	76.7%
Kaibab National Forest	8,633	3.1%
State:		
Land Department	15,665	5.6%
Camp Navajo (Division of Military & Emergency Affairs)	8,963	3.0%
Private/Other (includes local government)	32,082	11.5%
TOTAL	**280,655**	**100%**

We recognize that several smaller clusters of homes exist outside the identified at-risk communities and designated *Wildland/Urban Interface* zone but within the overall *Analysis Area.* Their exclusion in no way diminishes the need for those owners to undertake appropriate mitigation efforts or cooperative ventures between themselves and the adjacent landowner and/or jurisdictional authority. However, to include every parcel of private land within the *Wildland/Urban Interface* is to enlarge it beyond realistic treatment capabilities.

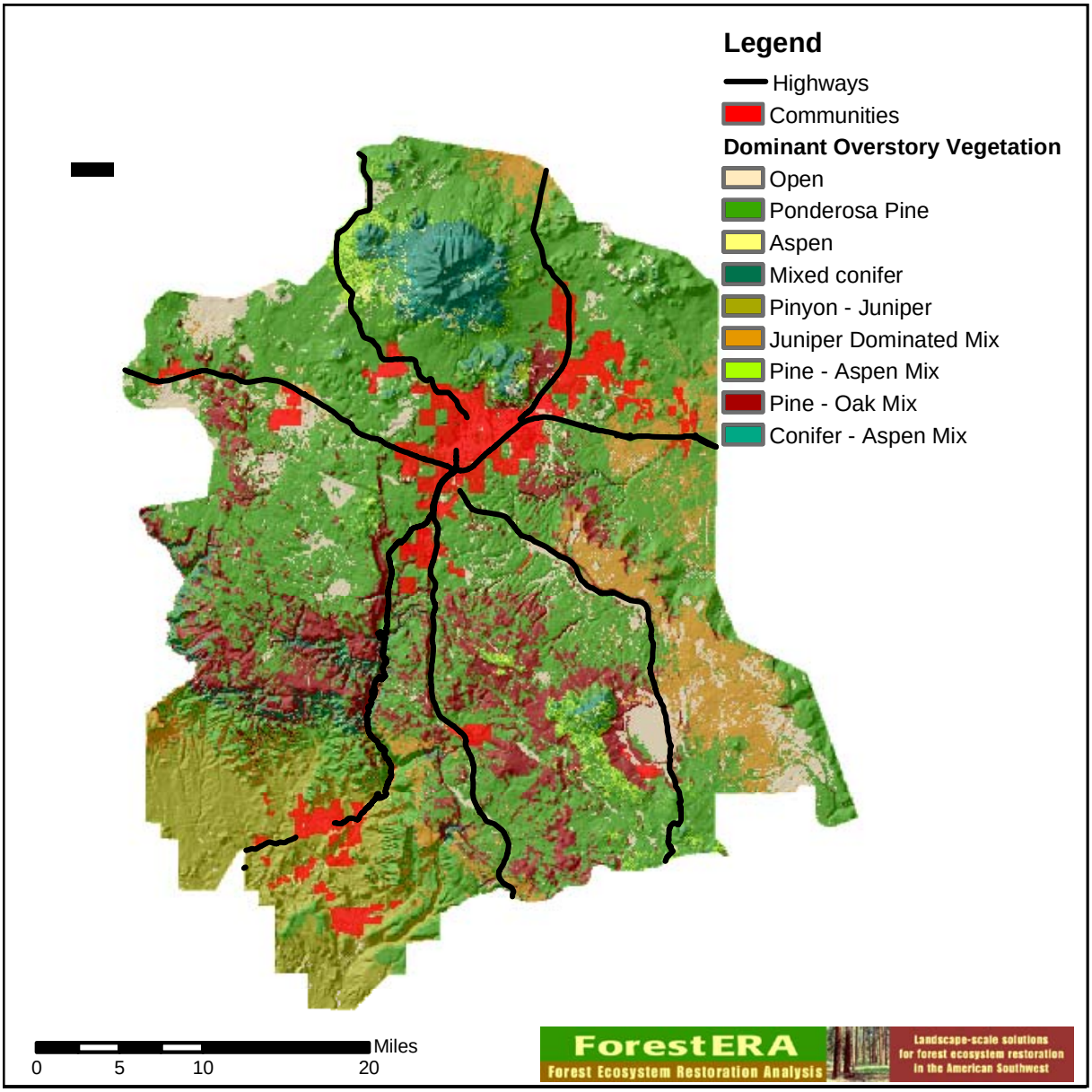
Fuel Hazard: Prior to European settlement in the 1860's, the forest around Flagstaff was comprised of relatively open stands of large-diameter ponderosa pine with scattered oaks, aspen, and other species, and intermingled with denser forests in canyons and on steep slopes, and with open meadows and grasslands common. Tree numbers averaged 30-50 per acre, with these trees arranged in small groups. While some young thickets and open meadows were undoubtedly present, a savanna community structure dominated the landscape. Fires were frequent, returning every 2-7 years, and were relatively low-intensity in nature.

Beginning in the 1880's, and extending until fairly recently, area forests were subjected to societal demands that resulted in intense livestock grazing, harvesting of large-diameter trees, and a policy of fire suppression that embraced fire exclusion. These actions led to profound changes within the forest and set-the-stage for the intense wildfires common today.

From 1917-1920, a period of relatively wet weather, in combination with the exceptional 1919 cone crop, resulted in the establishment of millions of new seedlings. These trees are the very fuels which stoke the wildfires common today.

Photo 4: A common scene in today's forest

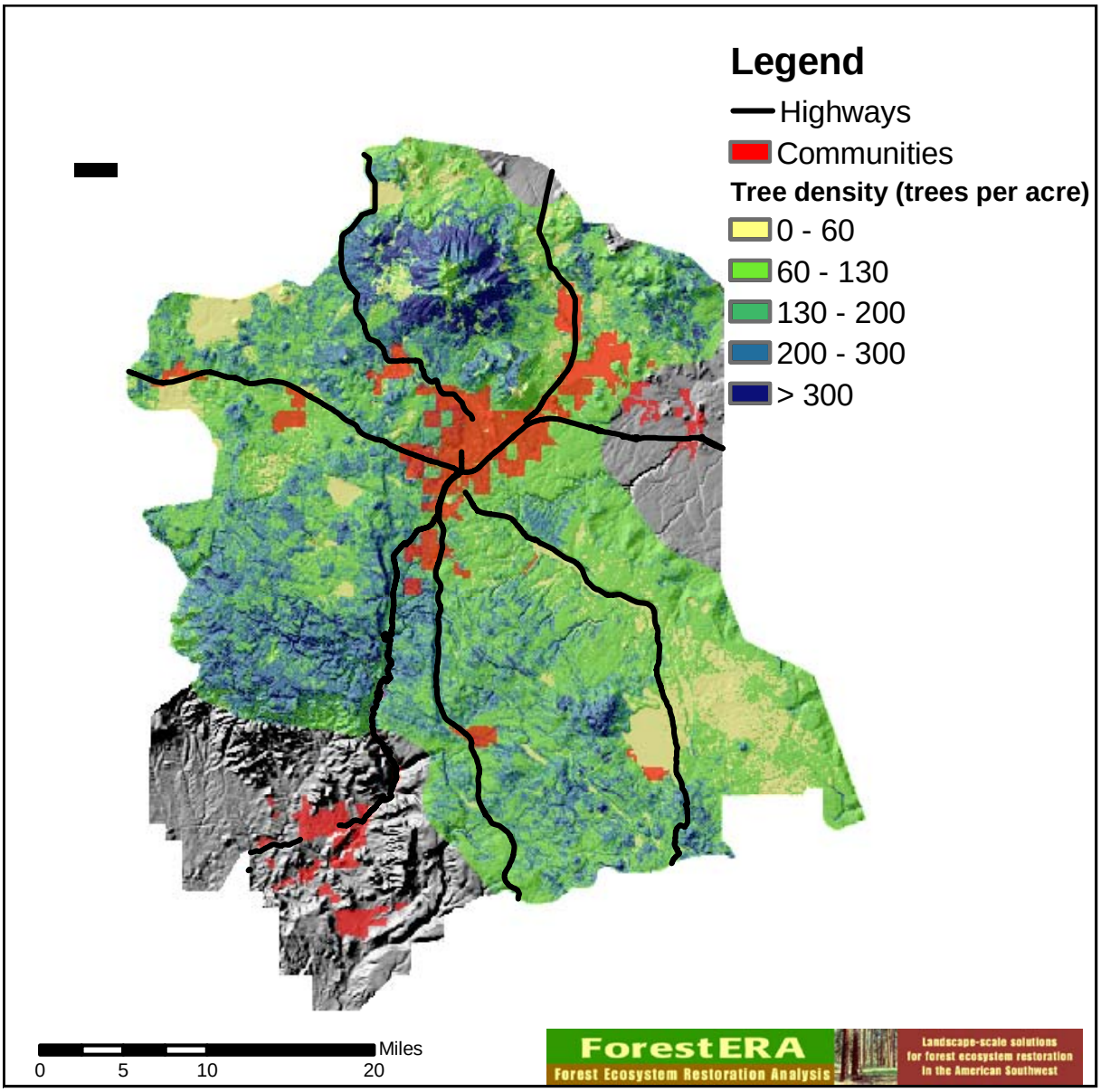
MAP 6



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

ANALYSIS AREA - DOMINANT OVERSTORY VEGETATION

MAP 7



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

ANALYSIS AREA - TREE DENSITY

As a result, many pine stands are presently overstocked with small and mid-sized second-growth trees. Basal areas commonly range from 150 to well over 200 and tree density from several hundred to over a thousand per acre. Canopy closure typically varies from 50% to 70% but often approaches 100%. An occasional juniper, pinyon pine, Douglas fir, white fir, Gambel oak, limber pine or aspen occurs among the pine stands. Insect and disease problems in these stands include dwarf mistletoe and periodic episodes of various bark beetles and other insects and disease.

Ponderosa pine sites, the overwhelming majority of the entire area, are best represented by Fire Behavior Prediction System (FBPS) Fuel Model #9 - closed-canopy pine stand with needle understory. In the few open areas, ground cover is a mix of grasses and forbs. Logging residue from the early 1900's such as pitchy high stumps and remaining cull trees contribute to the fire hazard and fuel laddering potential.

Fires are natural events, have been present since before humans occupied this area, and will continue to occur. What has changed, however, is the severity of fires we now experience. Our ponderosa pine ecosystem did not evolve with the fire intensity of today's fires, whether natural or human caused.

Three factors influence the spread of wildfire: fuel, weather, and topography. Of these, we can only manage fuel to reduce the intensity and spread of wildfire.

Fuel – The area around Flagstaff is part of the largest continuous ponderosa pine forest in the world. Natural fuel amounts have increased dramatically in the past 80 years. Homes and flameable structures are simply another source of fuel.

Weather – Historically, due to prevailing wind pattern, our local fire spread pattern is from the southwest to northeast. We also experience two other fire weather factors on a fairly routine basis that, like wind, are beyond our ability to control: low relative humidity and high temperature. The southwest is also in the midst of a persistent drought that has greatly increased vegetation mortality, thus increasing fire potential.

Topography -- Fires burn faster upslope than down. Canyons, ridges, and drainages funnel wind. South facing slopes dry quicker and burn more readily. Steep slopes present challenges for treating hazardous fuels, thus reinforcing the need to treat adjacent, more easily accessible areas, in a more intensive manner and at a greater scale.

Wildfires teach valuable lessons:

1. They occur in any season of the year. Although the primary concern (both in number and severity) is during the Apr-July timeframe, fire agencies in the area respond to wildfires virtually year-round when appropriate weather conditions exist.

2. They can be any size. Both small and large fires can be destructive.

3. They occur in any fuel type. Timber fires have the biggest flames, and offer the most resistance to control, but grass fires can be just as frightening to residents, and result in significant damage/loss to homes and infrastructure.

4. They can burn with incredible speed. Most damage within developed areas occurs within a relatively short timeframe. Once a wildfire encroaches upon a community, it is too late to implement widespread, highly effective mitigation measures.

5. Generally, there are seldom enough resources to protect every home, structure, or improvement during a large, catastrophic wildfire. Emergency responders are often forced to decide which homes to protect and which to abandon. Mitigation actions recommended and/or required and implemented now will make a tremendous difference in the survival of homes and property and the protection of community values-at-risk.

6. The trend in wildfire size and intensity, coupled with increasing awareness of other values-at-risk, is resulting in growing pressure to place firefighters in areas of greater-and-greater risk. Firefighter and public safety are the absolute first priority, but it is not uncommon for fire managers to find themselves at-odds with non-fire personnel who insist on dangerous and unsafe actions of questionable value. Responsible fire managers understand that permitting such actions violates their first priority and are obliged to refuse.

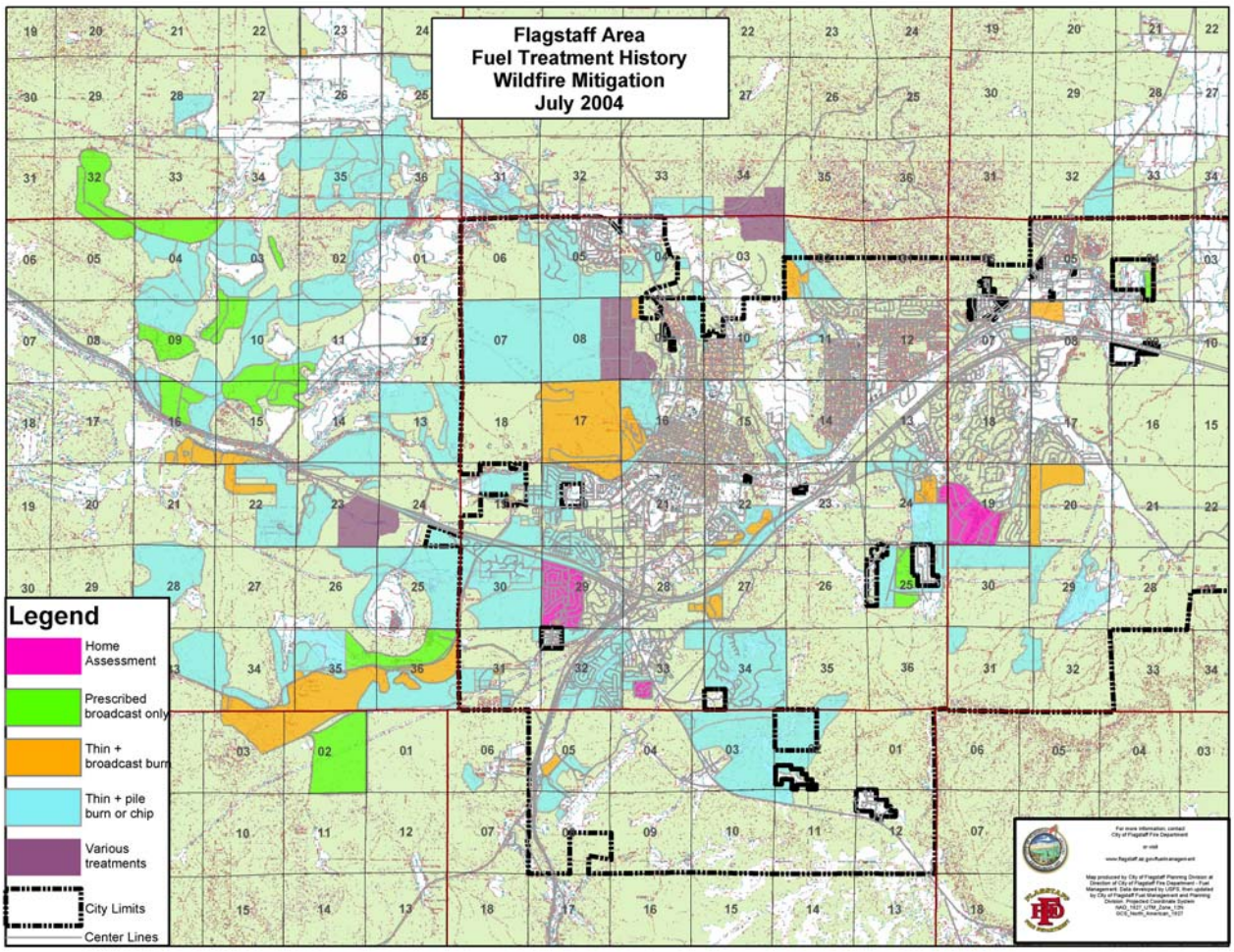
7. Wildfires do not respect boundaries or jurisdictions, and they have become increasingly destructive and expensive. A multi-agency, inter-departmental, and multi-faceted program approach is necessary to reduce risk prior to ignition; suppression actions alone are not the answer.

8. The question is not “if” a wildfire will occur, it is “when” and “where” it will happen.

To achieve ***community protection***, forest treatments and FireWise standards focused on public safety must begin in the *Wildland/Urban Interface.* First priority should be given to treating areas of dangerous fuels adjacent to communities, and then working outward in the W/UI. The overall scope-of-work is immense and the need to act quickly and decisively in this priority area is paramount. For ***community benefit,*** treatments in the *Analysis Area* focused on ecological needs and forest health, but reflecting the need to reduce fire threat, should also occur.

Important community protection and forest health restoration work has been implemented throughout the *Analysis Area* during the past several years, and plans are underway to continue treatments. As one example, treatments completed in-and-around the City of Flagstaff as of July 2004 are depicted in Map 8, which was compiled by the Flagstaff Fire Department.

MAP 8



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

COMPLETED TREATMENTS - City of Flagstaff Area – July 2004

Risk of Ignition and Occurrence: Wildfire is the #1 fire threat to Flagstaff and surrounding communities. The greater Flagstaff area averages around 150 ignitions per year (Map 9), while within the City of Flagstaff alone, there are roughly 60-80 wildfires each year.

Statistics from the entire Coconino National Forest (#1- #3 below), which includes areas outside the *Analysis Area,* illustrate both risk and occurrence:

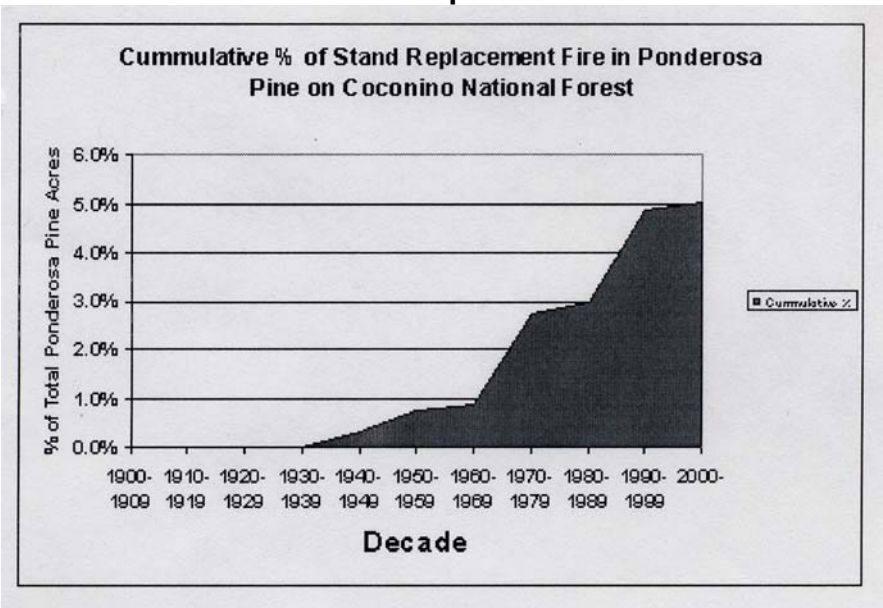
1. Total Fires - 1970 thru 2003:

Lightning Fires	10,377
Human Caused Fires	6,131
Total Fires (1970-2003)	**16,508**

Average per year (Lightning)	314
Average per year (Human)	185
Average per year (Total)	**499**

2. Growing trend of Stand-Replacement fires:

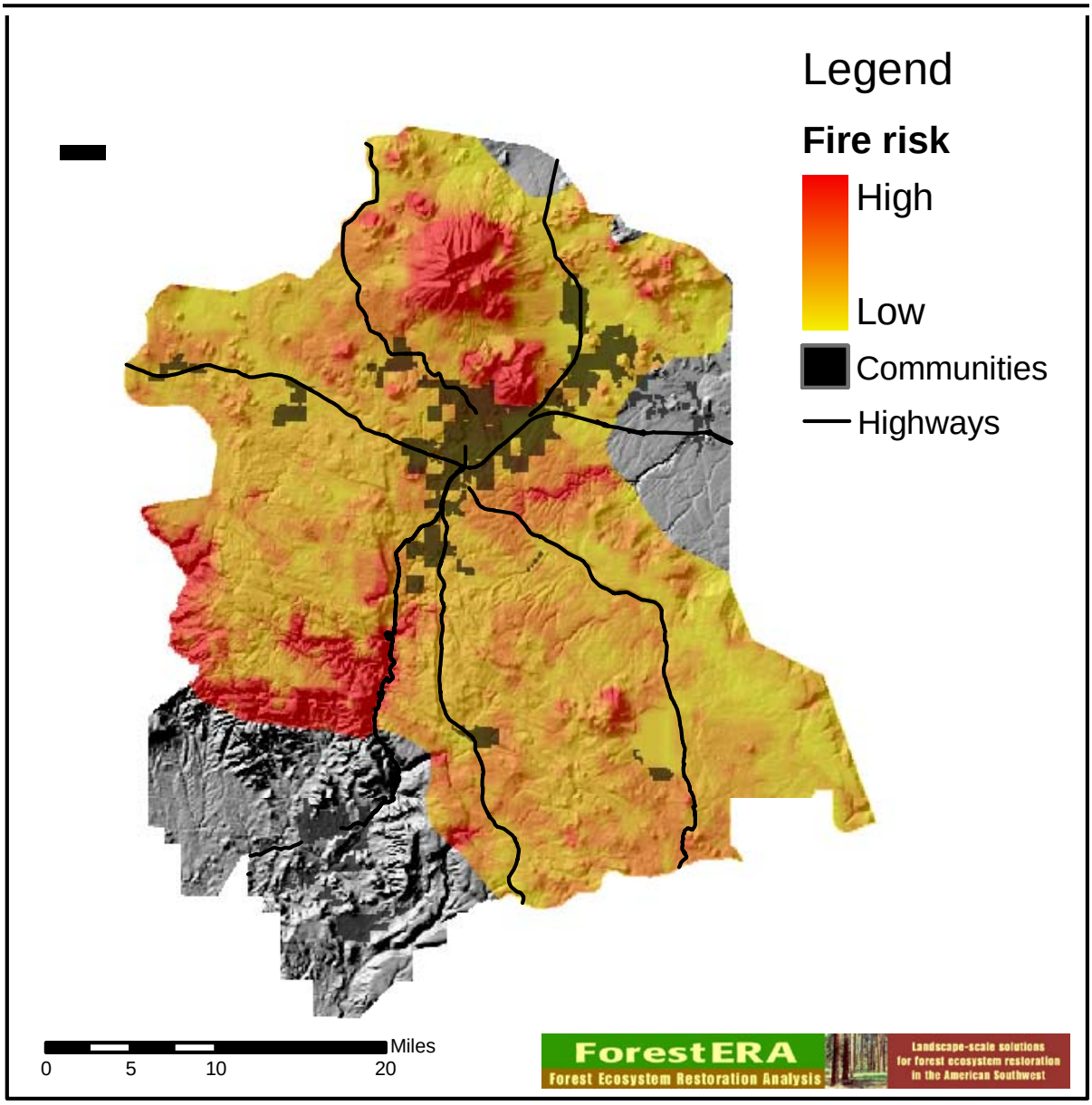
Graph 1



3. Closures/restrictions by lengths (based on fire danger):

1996	6 weeks
2000	3 weeks
2003	9 weeks

MAP 9



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

ANALYSIS AREA - FIRE RISK

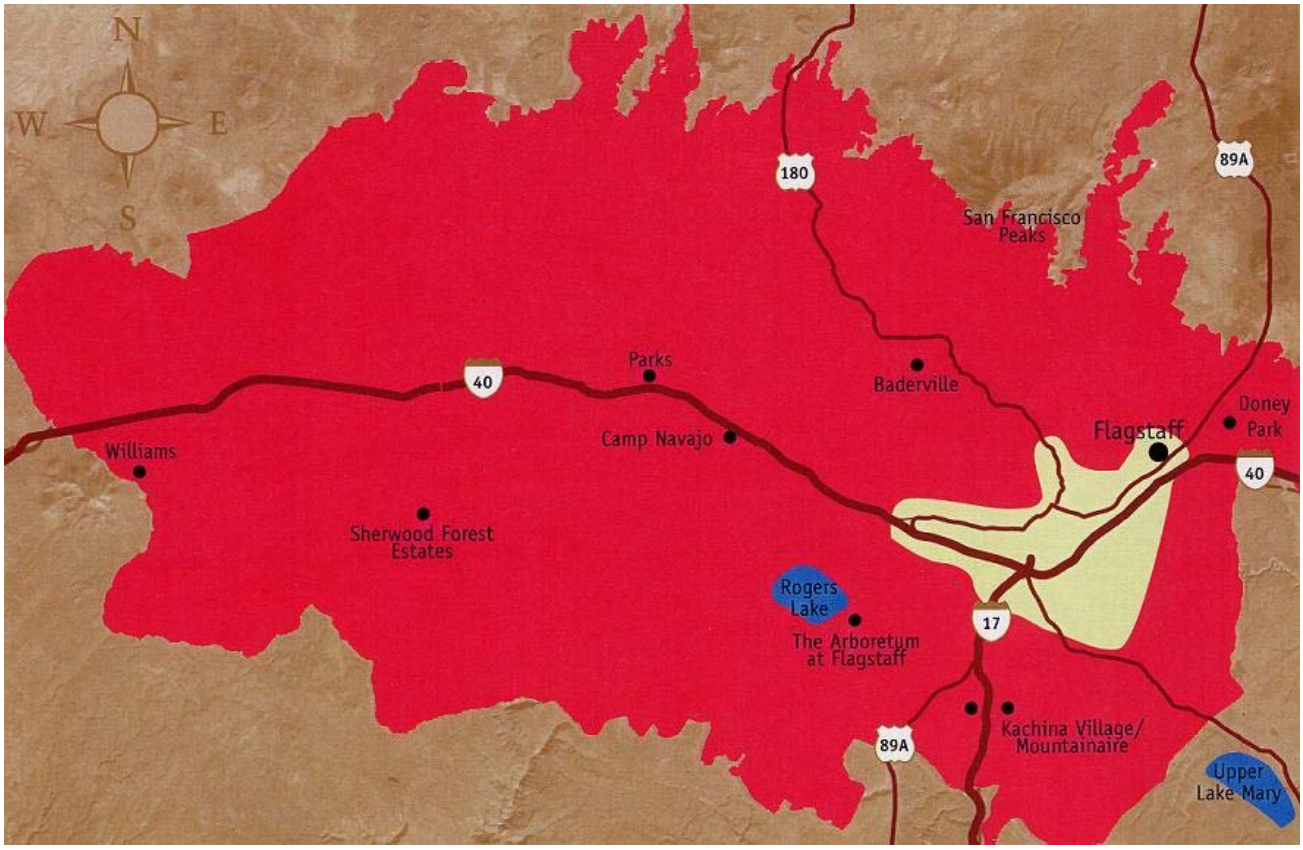
Community Values At Risk: The greater Flagstaff area is dependent upon a healthy forest for community well being. Catastrophic wildfire, fed by excessive fuel amounts, on-going drought, and devastating insect attacks, threaten a myriad of community values. These values may include scenic vistas, emotional and spiritual attachments, cultural resources, watershed values, wildlife habitat, old-growth forests, recreational opportunities, public health, firefighter safety, structures and other infrastructure, and public confidence in government. (A description of these can be found in the article *"The Wildland Urban Interface: What's Really At Risk?"* at the following web site: www.flagstaff.az.gov/fuelmanagement.)

Two other community impacts not commonly considered include the following:

1) The economic shock of catastrophic fires to a local economy is an important, and often overlooked impact. A recent study conducted by the Flagstaff Fire Department, with information supplied by the Greater Flagstaff Economic Council, the Chamber of Commerce, and the City's Sales Tax Division, and utilizing information from other communities affected by large fires, revealed that a fire which damaged and/or destroyed 300 homes in early summer – at the onset of the tourist and visitor season – would have a first-year economic impact to the greater community in excess of $60 million.

2) The Rodeo-Chediski fire (2002) was the largest wildfire in Arizona's recorded history and was visible from Flagstaff. Even though it was more than 80 miles away, it prompted tremendous public concern as evidenced by the large increase and tone of calls into the Flagstaff 911 Emergency Dispatch Center. By overlaying the boundary and footprint of that 460,000 fire on Flagstaff and the northern area of the CWPP (Map 10), we get a dramatic illustration of the extensive impacts a large fire like this might have on our area – communities from Doney Park to Williams devastated, wildlife habitat and critical watersheds stripped of their vegetative cover, decades to rebuild lives and centuries for ecosystem restoration. The scope of values that could be impacted is truly significant and just the potential for that type of wildifre occurrence is a primary driving force for creation of this CWPP - *to ameliorate the threat of such a fire to the Flagstaff and surrounding communities.*

MAP 10



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

OVERLAY OF THE BOUNDARY/FOOTPRINT OF THE RODEO-CHEDISKI FIRE ON FLAGSTAFF AND THE NORTHERN CWPP ANALYSIS AREA

Community Preparedness and Protection Capability: Two primary aspects of the existing readiness-level are found in the Appendices to this plan. Each has been slightly modified from their original document to better fit within the context of this plan.

Appendix 3 – Initial and Extended Attack Wildland Fire Operations Plan for the PFAC Response Area (Also known as the *"PFAC Ops Plan"*). This documents operational procedures to be utilized by all PFAC members for wildfires which do not exceed the complexity of a Type 3 incident.

Appendix 4 – Community Smoke Management Plan for the PFAC Response Area (Also known as the *"PFAC Smoke Management Plan"*). This documents actions to both minimize smoke impacts and educate the public regarding smoke from prescribed fire operations.

Each will be reviewed and revised on an annual basis by PFAC as part of that organization's annual work plan

Fuel Hazard Reduction: As indicated in the Introduction section, the CWPP is both a strategic plan and action plan: it provides a broad operating framework for all agencies and ownerships – private, city, county, state, and federal – within the area and identifies priority areas and treatments. Specific site prescription planning and implementation is the responsibility of each JHA, acting in consideration of the guidelines expressed within this plan.

Mitigation actions designed to reduce dangerous fuel accumulations within the *Analysis Area* are based, in part, on the *"Guiding Principles for Forest Ecosystem Restoration and Community Protection"* promulgated by the Governor's Arizona Forest Health Advisory Council (Appendix 2). These principles include:

1. *The overall strategy is dynamic, adaptive, and coordinated*. Given the current continuing decline in forest health, and the increasing threat of catastrophic wildfire, our actions to reverse this trend must be bold, large-scale, and undertaken immediately. All actions must be considered against the certain results of inaction, and must be continually monitored and revised as necessary.

2. *A sustainable community, with associated values-at-risk, is linked to a sustainable ecosystem.* Appropriate treatments must be based on social and ecological needs, and be geared toward reducing risk of destructive wildfire and restoring functioning ecosystems. Restoration efforts should be directed toward protecting and promoting development of old-growth and large trees, but not – if such a case should exist – at the expense of adequate fire protection to communities at-risk. Fire hazard reduction must be linked to the reintroduction of fire as a keystone ecological process. An active program of prescribed fire, including maintenance burns, and natural fire use, with implementation by land-managers on a site-specific need and basis, is essential. Vegetative treatments, and the pace of their implementation, will vary across the landscape, thereby creating an opportunity for biodiversity to exist and flourish.

3. *The immediate, but not exclusive, focus is on protecting communities.* A fire-resistive condition will be accomplished by modifying forest fuels at sufficient distances from structures and communities so as to reduce severe fire behavior, establishing defensible neighborhoods, and widespread use of fire resistant construction materials and architectural design.

4. *Necessary treatments, both-first entry efforts and maintenance activities, implemented and continued on site-specific needs, require a sustained commitment of public interest, political will, and financial investment.* Reducing wildfire risk and improving forest health is a long-term process measured in decades: because we are dealing with a living and dying ecosystem, it is one that will essentially be required forever.

Desired Future Conditions: Actions and treatments will leave both the landscape and at-risk communities resistant to catastrophic fire. Ponderosa pine stands will generally range from 30-100 larger-diameter trees/acre and/or basal area of 40-80/acre, be found in groups in varying degrees of interlocking canopy, and be separated by openings of various sizes. This pattern of tree clumps and openings will be variable and provide for a diverse, rich, robust and healthy ecosystem that supports a variety of butterflies, songbirds, mycorrhizae, carabib beetles, pollinators, grasses, flowers, shrubs and herbaceous plants. Further, it will avoid a homogenous, plantation appearance. Thicker groupings of trees, including all sizes, are found scattered throughout the larger area

Specific objectives related to fire behavior in ponderosa pine forest ecosystems (designed to make suppression actions easier, safer, and less costly, and to facilitate prescribed fire use), are as follows:

Table 7
Principles of Fire Resistant Forests
(Adapted from *"Forest Restoration and Fire-Principles in the Context of Place",* R.T. Brown et al, 2002)

Objective	**Effect**	**Advantage**	**Issues**
Reduce Surface Fuels	Reduces potential flame lengths	Less resistance to control	Less surface disturbance with fire than other techniques
Increase Canopy Base Heights	Requires longer flame lengths to produce torching	Less torching and resulting spotting	Opens understory: may allow surface winds to increase somewhat
Decrease Crown Density	Makes active crown fire less probable	Reduces crown fire potential	Surface wind may increase, with associated drying of fuels
Increase Proportion of of Fire–Resistant Trees	Thicker bark, taller crowns, higher canopy base height	Increases survivability of trees	Removing smaller trees is economically less profitable

These principles address only forested ecosystems. One quarter of the *Analysis Area*, such as areas around Sedona and Cosnino/Winona, is composed of other vegetation types, primarily pinon/juniper woodlands and chaparral. As better data becomes available on fire behavior and treatment effects in these vegetation types, this plan will be amended to address fire behavior within these habitats.

Treatment Guidelines: This plan provides recommendations for successful outcomes, and not prescriptive options for treatment of ponderosa pine forests. The following discussion is intended to serve as a general guide and framework within which specific prescriptions should be developed. Modification of these concepts, by the JHA based upon specific conditions and objectives for that specific parcel, existing land management plans, legal requirements, and other standards, will be required and is encouraged.

Tree Selection - Selective thinning from below, initially focusing on over-topped pines, is a priority. If possible, "leave" trees are left in a clumped pattern rather than evenly spaced. Openings created by the clumpy leave-tree pattern allow a fire to either drop to the ground or stay on the ground permitting effective suppression action. Clumps can vary from 1/10th acre up to as large as 1 or more acres in size. The number of trees in a clump may range from as few as two to 15 or more, with 30 or more occurring in a limited number of clumps throughout specific project areas. Trees, including the crown area, will generally occupy areas ranging from 20-50% of the area. Openings will range from 1/10th to 1-2 acres in size and constitute a variable of 50-80% of the area.

In general, trees designated for removal exhibit one-or-more of the following characteristics:

1. Contributes to crown-fire behavior: ladder effect into the overstory canopy, low crown-base heights, dense interlocking canopies, etc.
2. Are vulnerable to drought or insect infestation: suppressed, reduced vigor, etc.
3. Currently infested with insects that threaten to spread to other trees, unless the tree is to remain for other benefits.
4. Infected with dwarf mistletoe: Stands with high infestation levels of dwarf mistletoe can be thinned or pruned to reduce crown fire potential during the inevitable wildfire. Small pockets of mistletoe can be Isolated from non-infected trees by a barrier of fifty feet (to reduce further spread of the parasite), or removed.

Conversely, trees considered for retention, will be those, unless other issues or benefits prevail, which are often:

1. Clustered around evidences of historic forest structure (ex: downed logs, stumps, stump-pits, etc) or, alternatively, based on best existing forest structure.
2. The largest diameter, exhibit high crown-base heights, and are the most fire resistant:
3. Old trees exhibiting yellow bark.
4. Oaks, aspen, or other species of wildlife or ecological value

NOTE: a) Some variation is needed: trees may vary in-height. Stands should include small intermediate size trees, saplings and seedlings, but none of these should threaten larger, older trees during a fire.

b) In the absence of prescribed fire, clumps may be prone to loss due to high surface fuel loadings: retention of clumps requires periodic use of fire.

Removal of the larger diameter trees in a stand, including standing dead snags, is to be avoided unless cutting is required to adequately reduce fire risk, provide for public safety or protection of improvements (ex: trees leaning over home, play area, power line, road, or hiking trail), or for some other ecological benefit. (Removal of "large" trees is a significant issue for many groups and individuals. The GFFP has been discussing this issue for several years and is currently considering adoption of *"A Management Policy for Ponderosa Pine Forest Structure in the Flagstaff Wildland/Urban Interface".* Such a policy, when adopted, should be incorporated into revisions of this CWPP to address this issue.)

When designating trees for removal, personnel must be aware of fire behavior alignments such as prevailing wind direction, shading, slope, fuel arrangement and continuity, including interlocking crowns, and potential suppression strategy and tactics best-suited to the individual site.

Wind-driven fires are not uncommon in our area. To provide optimal protection, treatments are required upwind of at-risk communities – south and west in our area – to a greater distance to provide adequate protection. Conversely, treatment distance north and east of at-risk communities can be reduced unless circumstances dictate otherwise. However, one should be mindful that plume dominated fire behavior results in extreme fire spread from spotting of several miles in all directions and should be expected.

Topographic features – such as canyons – directly influence fire behavior, but may be impractical to treat due to slope, soil sensitivity, safety, expense, and other values such as critical wildlife habitat. This lends emphasis to enlarging treatments where fire is expected to emerge from a canyon and where firefighting forces have the best opportunity for control

Overall, this approach is considered to be an intermediate-intense modification of most existing stands, involving removal of 50-75% of the existing trees. Experience has shown that over the entire area, many, but not all, of the trees to be removed will be smaller diameter.

Cutting Techniques - The type of mechanized operation is obviously important when conducting treatments. A traditional harvesting operation may be the preferred method in some areas, while in others it may not. For the later, a "micro" harvesting approach may be required: trees are cut either using hand-crews with power saws or by a small shear, and wood can be moved by an All-Terrain-Vehicle (ATV) with a trailer or some other small-equipment approach. Such an approach, however, will likely lengthen the time required to treat the parcel, and may result in higher costs and pose an increased risk to the operator.

Restricting hours of operation in response to local conditions and neighborhood concerns may be warranted. For example, if an operation is immediately adjacent to homes or a neighborhood, activity may need to be restricted to normal working hours within a reasonable distance to lessen the impact to residents. However, doing so should be done with the realization the operation will extend further into the future.

Stumps should be cut as low to the ground and as level as possible. This not only improves post-treatment visual quality, but permits easy access for wood removal and other subsequent land management needs. However, potential adverse impacts from unrestricted post-treatment access (ex: soil compaction, erosion, etc) should be addressed in the planning phase of a project, and subsequently managed.

Utilization - The majority of material available for wood production from the greater Flagstaff area will be small diameter ponderosa pine. Opportunities for using this material are constrained by a number of factors including high harvesting costs, structural properties associated with juvenile wood, and a lack of consistent markets and processing facilities. Harvesting costs associated with forest restoration and community wildfire protection, including transportation and handling of raw material, are often quite high even where larger, high-value trees can be harvested. These costs can be prohibitive for smaller businesses.

The difficulty in finding suitable markets for this small diameter material is magnified by poor mechanical properties that make it unsuitable for all but the least demanding structural uses. It is characterized by suppressed growth with low tension and strength due to a high ratio of juvenile wood and difficulty in product drying. Finding suitable markets is further complicated by the fact that currently there are virtually no outlets for the types of timber that will be harvested. New processing facilities will have to match the types of wood material available with the use of contemporary utilization techniques.

Northern Arizona and Flagstaff is uniquely situated to capitalize on contemporary opportunities for solid wood and biomass utilization. (See Appendix 6 for a complete description of this topic.) Solid wood applications in which businesses are actively exploring or have already invested in the Flagstaff area, include roundwood construction, composite products like oriented strand board (OSB) and wood/plastic materials, and engineered lumber like glu-laminate beams and finger-jointed lumber. Biomass applications include wood chips for baseload energy production, densified fuel pellets for heating, and biochemical extractives. Other products for which small diameter pine is currently being used in the region include firewood, posts and poles, landscaping timbers, ground covers or mulch, pallet manufacturing, and crafts.

Photo 5 – “Traditional” harvesting operation

Photo 6 – “Micro” harvesting: cutting with a small shear

Photo 7 – “Micro” harvesting: Skidding wood with an ATV
(Roll-over protection recommended for this type operation)

Slash Treatment – Four general slash-disposal methods exist and each may be utilized under the appropriate circumstances. Regardless of the method chosen, the required work (such as piling) should be completed as soon as possible after it is generated.

Hand Piles: This is a common practice of handling slash. Hand piles should be a minimum of six feet tall and six feet wide. Piles should be located in openings to minimize scorching leave trees when the piles are later burned. Likewise, placing piles on top of old stumps or logs should be avoided to reduce both the amount of smoke and the chance for "creep" when the piles are later burned.

Machine Piles: This method is feasible and widely utilized. It is particularly appropriate on larger projects and in more open areas. Piles are typically much larger than those created by hand-piling. Whole tree skidding may also be used with the piles created at the landings. Windrows may also built using dozers: this technique has been successfully utilized in the area.

Chip or Grind: Although occasionally used, this technique is comparatively expensive and chips decompose slowly in our area. If future under-burning is anticipated for the site, chips may add to smoke management problems. The material can, however, be used for mulch or decorative landscaping. Hauling chips to a disposal site is expensive.

Lop-and-Scatter: This method, where material is cut so it is less than 12-24 inches above ground-level and then left on-site, should be carefully considered on sites immediately adjacent to structures. If the amount of slash is light and the manager can complete a broadcast burn as soon as the material has dried, it may be effective. However, due to the increased fire hazard, as well as visual concerns, this method is not as common as it once was, and adjacent to homes, it should never be left in-place for an extended period.

Pile Burning - Piles should be burned only when consumption will be greater than 90%. All pile burns should be conducted under conditions intended to minimize scorch and smoke impacts.

Because the ultimate intent for many treatment sites is to conduct a broadcast burn, some existing dead-and-downed material can be piled during the thinning operation. These piles could then be burned alongside thinning-material slash piles. Although there are financial costs of doing so, which may be prohibitive depending upon the site, removing these materials during the pile burn phase does result in decreased smoke emissions during the subsequent broadcast burn.

Hand Piles: As a standard practice, these piles are burned either when snow cover exists or during an extended wet weather episode. Once ignited and as they burn-down, the piles can be periodically consolidated to ensure complete and timely consumption. Ignited piles should, if at all possible, burn-down by nightfall to minimize smoke impacts to area residents.

Machine Piles: Like pile burns, this type operation requires either snow or an extended wet weather episode. These type piles typically are larger than hand-piles, and will therefore burn longer once ignited. The advantage is that there are fewer piles per acre and they can often be burned under wetter conditions than possible for hand-pile burning.

Photo 8: Pile burn operation

Broadcast Burning- Treating ground fuels is a critical component of any effort designed to reduce fire threat, and it has added ecological benefits, such as recycling nutrients. Once an area has been thinned and the slash has been treated, or where a burn only treatment is designated, the site can be broadcast burned. Firelines are usually constructed by hand or with a drag pulled by an ATV, or the burn crew can use natural breaks or roads/trails as a containment line.

Where site objectives dictate that standing dead trees and large downed woody material need to be protected, they can be either hand lined or otherwise excluded from the burn block. Extra protection measures may not be necessary for many fire-tolerant cultural or archaeological sites: treating these areas with prescribed fire has the advantage of protecting them from emergency suppression activities during a wildfire.

Photo 9: Broadcast burning can be successfully implanted both in the forest and adjacent to homes

Deep duff and needle accumulation at the base of the larger older trees will often smolder for days. This essentially bakes the cambium layer and can lead to tree death 1-2 years, or more, after the burn. To avoid this potential loss, the site should be evaluated prior to ignition. If necessary, duff and needle material can be raked-away from high-risk trees: usually raking to a distance of one foot from the bole is sufficient.

Historically, large-scale broadcast burning has occurred in the fall, and to a lesser extent, during breaks in the summer monsoon season. Within the past few years, however, in response to smoke management objectives, burning is also occurring in the spring. As the demands to boost prescribed fire use increase, one option to enlarge the burn "window" is to shift more burns into the spring and summer months to recreate the historical fire regime. This, however, is a more challenging time to use prescribed fire and will depend on the availability and preparedness of appropriate resources at the local, regional and national levels. Summer burning should become easier, from a fire behavior standpoint, once a site has been previously burned and excessive accumulations of fuel are removed.

Under-burning in pine stands generally calls for target flame lengths of 1 to 3 ft, although some sites require a "hotter" burn to achieve resource objectives.

Ignition by hand with drip torches or with ATV-mounted torches is preferred. Burn operations usually begun by mid-morning following the break-up of the night time temperature inversion and the establishment of the day time wind pattern. Completion of ignition should be targeted early enough to ensure adequate smoke dispersal prior to the onset of cooler nighttime temperatures.

Every burn is to have a completed burn plan. Among many items in this plan are specific objectives for the burn. These may include, but are not limited to, such items as:

1. Fuel Reduction (fuel size classes, %'s, etc)
2. Tree Mortality
3. Scorch

Extensive public notification is an essential element of the program. This can be achieved by posting signs in the area announcing the proposed burn, news releases, and in many cases, door to door contact throughout the nearby neighborhood(s). A continuing education program through talks to civic groups, service clubs, and others to inform the community of the importance and benefits of the program are important as they generate understanding and support for the effort.

Local experience has shown that a previously notified neighborhood is willing to tolerate smoke for a day, but after 2-3 days, patience wears thin. If a particular log, stump, or site within a burn unit becomes a major concern to nearby resident(s), the responsible fire manager may decide to extinguish it the first night.

Burn units should be designed so they can be dispersed throughout the area so as to not constantly impact the same neighborhood(s). Neighborhood air sheds, indicated by diurnal smoke flows, are key to managing nighttime smoke impacts.

Maintenance: Once thinning, slash treatment, and first under-burning have been completed, the treated area constitutes an effective fuel-break for the next several years. Follow-up thinning and maintenance burns must be scheduled as necessary to ensure the treated areas remain free of the risk of catastrophic wildfire. Adequate access must be assured, not only to conduct needed follow-up treatments, but also to permit rapid response of fire suppression forces. As part of a long-term maintenance and fire management program, fire containment and wildland fire use should be emphasized as appropriate management options for fire restoration.

Community Involvement - Throughout any treatment operation, the Project Manager must maintain contact with potentially affected residents. Input and concerns from such persons must be considered, and where possible, incorporated into the overall effort. Treatments bordering neighborhoods should be explained to residents: one approach would be to go door to door to each residence, explain the project, and gather first-hand comments. In particular instances, a "case-officer", assigned to a specific resident, may be desired so that one person deals with that individual throughout the life-of-the project.

Photo 10: Public involvement is critical to success

Costs - Individual project expenses vary tremendously from site-to-site based on ownership, size, complexity, and need. It is difficult to compare one site to another, especially initial treatment vs. maintenance requirements. Table 8 on pg. 58 presents "average" costs associated with CWPP treatment recommendations in order to establish a ball-park figure of what it may cost to achieve the fire behavior modifications described in this plan.

What should also be considered is the cost of doing nothing. For our area, it is no longer a question of "if" a wildfire will occur, but "when", "where", and "how much damage" will result. Working with residents before the wildfire, not during or after it, is preferred.

Benefits – Experience with wildfires burning in previously treated areas demonstrates the following:

- Improved access for fire fighters and apparatus
- Increased efficiency when locating and constructing firelines
- Easier detection and suppression of spot fires
- Decreased mop up time and effort
- Reduced fire intensity, torching and mortality
- Improved public safety
- Reduction of loss
- Reduction of air emissions

Another benefit, particularly in interface areas, is reduced trash accumulation through elimination of hiding cover necessary for transient camps and party spots.

Recommendations and Guidelines – Experience with *Interface Zone* treatments has led to development of the following procedures:

1. Involve those potentially impacted or affected from the very beginning.

2. Once the project is started, commit to complete it in a timely manner.

3. Use signs, news releases, and other appropriate methods to update people on the status of the project.

4. When mistakes occur, which can and will happen, immediately notify adjacent residents, explain what happened and why, and advise them of what is being done to correct the situation. Assume full-responsibility: allow on-site personnel to make commitments to address a problem.

5. Document and follow-up special concerns or small details that may be important to a concerned individual. Personal "client" service is an absolute necessity. All involved must always strive to establish and maintain professionalism, integrity and credibility.

6. Project staff must stay focused on the ultimate goal. Reduction of fire risk requires the active and on-going involvement of all.

7. Success leads to success. Recent history has demonstrated that many landowners throughout the community have seen ongoing and completed treatments and have implemented similar treatments on their own land.

Wildfire Prevention and Fire Loss Mitigation Two documents and one area-of-emphasis contribute greatly to community protection. They include:

Coconino NF Prevention Management Plan – See Appendix 6. Only a few pages of the plan are included to demonstrate the ongoing prevention efforts of the USFS. For detailed annual activities under the plan, visit their web site at: www.fs.fed.us/r3/coconino.

Volunteer Agreement – Within the past month, an agreement between the USFS and various Fire Departments and Districts, has been finalized. A long-sought objective of PFAC, the agreement allows Fire Departments and Districts to volunteer personnel and equipment to USFS prescribed burn operations. This promises to permit effective hands-on training and greater treatment accomplishment than previously possible.

Structure Ignitability – Implementation of measures to reduce fire risk and improve community protection are not restricted to federal, state, county, or city lands: they must also occur on private property. The interested reader is encouraged to visit www.firewise.org for additional details, or contact either the State Land Department or the appropriate Fire Department or District (see Section 5, p.71).

Wildfire suppression will always be needed, but preparing and equipping homes and neighborhoods to live in a fire-environment is just as critical. Developers and property owners can greatly enhance protection of their investments by establishing a FireWise property and neighborhood. This is done by:

A. Development Standards – Working with both Planning Departments and developers and property owners to incorporate FireWise techniques prior to construction can significantly reduce fire threat and improve public safety. Efforts undertaken with a single owner prior to individual lot development is very efficient and greatly preferred. Fire Departments and Districts can provide fuel reduction, access, water source, and street width and slope standards, along with bridge load limits and other fire protection needs/requirements during the planning stage, prior to actual development.

B. Hazard Fuel Reduction – Treatment of an entire property, rather than a narrow strip or portion of a site, is the recommended and preferred method. Doing less simply creates the illusion of home or neighborhood protection.

Treatments include selective thinning, brush disposal, and prescribed fire. Varied levels of treatment can occur on the property based on density and species of vegetation present, and location in relation to topography (ridge top, slope, aspect, presence of steep drainages, etc).

The goal is to keep fire intensity low, keep the fire on the ground, and limit flame exposure to structures. This can be accomplished as follows:

1. Thin to reduce crown density with canopy breaks to eliminate crown fire spread,

2. Eliminate low-hanging branches and other material which allows a ground fire to climb into trees (ie - ladder fuels), and

3. Reduce excess fuel accumulations through removal or prescribed fire.

Depending upon the property, these actions can generate large amounts of material that require disposal. Methods utilized are often dependent upon such factors as amount produced, property location, and any restrictions currently in-effect. Techniques include burning, bulk curbside pick-up, transport to a waste management facility, or transformation into a useful product: examples of the later approach include removal for firewood or chipping for landscape use.

C. Fire Resistive Materials and Construction Techniques – Incorporation of these items into the design and construction phases of a building project directly contribute to structure survivability. Examples include:

1. Non-combustible roof material: Minimum of Class B or better.
2. Limited combustible siding: large logs, stucco, rock, etc.
3. Enclosed soffits
4. Screened roof and crawl space vents: minimum of ¼ inch wire screen.
5. Limited combustible decking material: to further promote FireWise efforts, enclose and/or keep areas underneath clear of debris.
6. Double paned windows.
7. Glass skylights (rather than plastic)
8. Home suppression systems: several types are now entering the marketplace. Activated in advance of an approaching wildfire, they are a viable form of home defense. However, they do not replace the need to create a FireWise home environment utilizing all the techniques described in this section of the plan.

D. Landscaping – Outdoor plantings are an important component of our community. They add shade and beauty, buffer noise, provide privacy and inspiration, and supply habitat for wildlife. Proper selection, placement, and maintenance of landscape plants can provide the desired benefits and not increase the risk to home and property. However, improper selection, poor placement, or deficient maintenance of plantings can directly contribute to the destruction of a home during a wildfire event. PFAC has produced a brochure on FireWise landscaping – consult their web site for details.

There are four attributes of vegetation that should be considered when purchasing, planting, or conducting maintenance:

1. Location: Vegetation can be close or even adjacent to a home, provided it is of the right kind and not part of a continuous “fuel-bed” leading up to the house. Adjacent to a home, “specimen” type shrub and tree plantings should be considered. These plantings should be isolated from others through both horizontal and vertical separation: grass, flowers, cinders, or mulch can be used to fill-in the gaps.

2. Type: Highly flammable plants high in oils or resins should not be planted close to structures. These plants will ignite easier and burn hotter than other types of vegetation. If such plants are already in-place, consider removal. If unable to do so, separate them from other existing vegetation by removal of adjacent plants. Favor plants which naturally have a high moisture content as evidence by leaves which are often thick, soft, and pliable. Ignition can still occur, but it will take longer and they will not burn as hot.

3. Amount and Arrangement: Large plants are acceptable, provided they are not crowded together in a continuous planting. Tree branches should not interlock and form a closed, continuous canopy overhead. Such an arrangement allows heat and fire to be easily transmitted from one plant to another. Shorter plants should not be placed where their presence could provide a "ladder" for a ground fire to climb higher into adjacent vegetation, thus endangering the home. Consider plants that are low growing: If ignited, there will be less material to burn. Be sure to inspect these plants regularly and remove any fallen leaves and needles that might collect in or under them. In addition, dead material in plants should be removed during routine maintenance. Weeds and grass should be routinely mowed to a height of two inches or less.

4. Vigor: Healthy plants are better able to withstand the challenges of our environment. Plants should be watered as required. Consider use of native plants, many of which require less water than exotics. Mulch should also be utilized to reduce watering needs: wood chips are OK provided they are placed so not to form a continuous fuel bed leading directly to the house.

E. Annual Maintenance – Maintaining a FireWise property will decrease yearly fuel accumulations and limit potential ignition sources that could cause structures to ignite. These include:

1. Eliminate readily-combustible materials (ex: needles, hay bales, firewood, etc) to a distance at least 30 feet from structures.

2. Clean needles, leaves, or any other combustibles from roofs, rain-gutters, and under decks.

3. Remove tree limbs which overhanging fireplace chimneys.

4. Clear vegetation around propane tanks

5. Remove dead vegetation

6. Mow weeds and grass to less than 2 inches in height.

7. Remove branches and limbs that are within six feet of the ground

F. Home Assessments – Fire Departments and Districts will conduct a free home/property assessment, upon request, to educate owners about fire threat and provide recommended mitigation methods.

G. Neighborhood Coordination – Individual home protection is a necessary first step, but to achieve community protection, defensible neighborhoods are critical. Recent fires have conclusively demonstrated that an approaching wildfire can ignite individual structures, triggering a neighborhood conflagration beyond the response capability of firefighters. Interested individuals, Home Owner Associations and others, such as Block-Watch or Woods-Watch groups, can be the needed catalyst to spur neighborhood action to reduce fire threat.

Improved Protection Capabilities: Several potential activities and efforts should be initiated or further developed, thereby increasing community protection. These include, but are by no means limited to, the following:

1. *Survey existing neighborhoods.* Identify, map, and prioritize neighborhoods for neighborhood-wide home ignitibility reduction.
2. *Establishment of a Regional Fuels Crew* – This would involve many different partners and require sufficient funding. Principle among the partners would be PFAC members, but it could also involve NAU-ERI and GFFP as well. The consolidated crew, larger than current separate efforts, would be under single leadership with standardized training, equipment, and treatments standards. In addition to mitigation and prevention efforts, the crew could be available within the local area for fire suppression needs throughout the year.

3. *Increased Public Education activities: Utilization of new outreach methods to prepare the community to receive fire* – Currently, there are a number of education initiatives and outreach methods underway by area partners. These include public meetings, presentations to service clubs, civic organizations and homeowner associations, media notices, periodic workshops and symposia, development/distribution of material, and participation in community events such as the Forest Festival, Science In-The-Park, and the County Fair. Future activities might include involvement in the Northern Arizona Home Show, public service announcements, airing of informational videos on Public Access TV and public service announcements on commercial TV, recognition of FireWise communities by the national FireWise program, and development and maintenance of a joint-agency website devoted to this issue.

4. *Develop/adopt/implement Legislation & Appropriations (State/Federal)* – Adequately fund and/or support, with sufficient oversight to ensure proper and timely application. Items of current interest include:

5.

a. Federal –

(1) **National Fire Plan** (particularly those areas having to do with assistance to local government via the State Fire Assistance grants and other mechanisms),

(2) **Healthy Forests Restoration Act** (chiefly to ensure professional planning and an increased level of forest treatment implementation, tied to appropriate plans),

(3) **Forest Landowner Enhancement Program** (a highly effective forest treatment cost-share program for private landowners).

(4) **Ecological Restoration Institute of Northern Arizona University** (provides the scientific foundation and academic credibility to our efforts, as well as a source of student interns and seasonal employees), and

(5) **Local Community Partnerships/Collaboratives** (provide interface for federal agencies to address community needs)

b. State:

(1) **Implementation of HB 2549**, comprised of the following five actions:

i. Healthy Forest Enterprise Assistance Program (Incentives for wood-based businesses)
ii. State Forester (establishes office w/associated duties)
iii. Biomass Energy (Directs State to purchase)
iv. Urban-Wildland Fire Safety Committee (establishes 12-member committee w/associated duties)
v. Interface Code (Permits adoption of code, per Wildland Fire Safety Committee)

(2) **Adopt the remainder of the Governor's Arizona Forest Health Advisory & Oversight Councils recommendations**, provided spring 2004. Among others:

i. Increase local planning & zoning authority
ii. Require real estate disclosure statements

(3) **Revise the current Environmental Portfolio Standard** (AZ Corporation Commission) to eliminate the expiration date, include a larger total percentage of renewable energy, and emphasize use of biomass energy production.

4. *Recruitment of small-diameter, sustainable wood-based industry* – Utilization of the large amounts of biomass that must be removed from area forests is critical to success. This issue is covered elsewhere in this Section (See Utilization, p. 40).

5. *Fire District Formation* – Some outlying homes within the CWPP are outside existing Fire Districts. Owners within these areas should seriously consider formation of Fire Districts – via the County – to facilitate emergency response, prevention, and mitigation efforts.

6. *Compatible data-layers for the Sedona and Winona area to facilitate analysis of the entire CWPP area* – Key information used in the development of this plan is lacking for the Sedona and Winona areas and/or not in the same format as that for the remainder of the area. This somewhat complicated our use of the work of the NAU-ForestERA project. Comparable data for areas with gaps should be developed to make future revision of this plan easier.

7. *Develop a standardized Neighborhood Wildfire Assessment format* – The City of Flagstaff has recently received a donation from Allstate Insurance Foundation for just such an effort. Once developed, it can be readily transferred to other jurisdictions within the CWPP area. The information derived from this effort can augment the threat matrix data contained in this plan, as well as become an educational outreach tool to residents.

8. *Incorporation of CWPP into on-going activities and established land-management and agency plans* – Both PFAC and the GFFP intend to utilize this document to prioritize actions, secure funding, coordinate activities, implement treatments, and monitor desired outcomes. The CWPP also provides guidance to private citizens in their effort to reduce their exposure to wildfire.

9. *Identification of additional resource and equipment needs* – Individual agencies are responsible to provide appropriate administration and planning for their respective organization. In addition, and to facilitate joint discussion and interoperability, PFAC, on an annual basis and with any needed assistance from GFFP, will host a multi-party discussion of current fire response capability within the CWPP area. Centered on the goal of reviewing and revising the PFAC Operations Plan (Appendix 2), the discussion will include all facets of fire management resources and other topics that may be appropriate.

10. *Funding* – This plan, and implementation of the identified activities, is intended to demonstrate our intent to implement and provide general information to appointed and elected officials and grant-funding organizations and agencies. Our coordinated effort to protect the greater Flagstaff community is a key ingredient to attracting additional funding to further implementation efforts.

11. *Wood Distribution Networks* – Establishment of on-going relationships with individuals and organizations on both the Hopi and Navajo Reservations, as well as with large charity organizations with interest and capability in wood delivery/distribution efforts, is an important utilization initiative. There is tremendous need for wood products – primarily firewood and posts-and-poles throughout both areas. It is estimated that over 75% of all homes on the Reservations have no electricity and require wood for heating and cooking. Creation of a steady "wood-pipeline" will not only benefit those who receive the wood, but also assist in reducing fire threat in our area by removal/utilization of excess small-diameter trees.

12. *Statewide Mapping Effort* – The "Arizona Fuels, Information, Restoration, and Education Mapping and Assessment Program" or ARIZONA FIRE MAP, is designed to establish and maintain a GIS-based mapping system that will document forest treatments, CWPP status, grant receipts, etc. Forest treatments within the Flagstaff area have been used to develop a prototype map. Involvement with this effort, as it develops, will ensure our area remains at the forefront of statewide activities.

13. *Coordination with adjacent areas during development of their respective CWPP* – Two adjacent areas where future plans may be developed are Sedona/Verde Valley and Williams/Parks-Bellemont. Both Sedona and Parks-Bellemont are included in this plan: inclusion in another plan is encouraged, but synchronization will be required to ensure management conflicts do not occur.

14. *Adoption/implementation of the Coconino County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) and the Coconino County Emergency Management Plan (EMP)* – Wildfire has been identified as one-of-five priority hazards within the County. The MJHMP, upon approval by the Federal Emergency Management Agency (FEMA) opens-the-door for pre-disaster mitigation funding and facilitates post-disaster mitigation and recovery efforts. The all-risk EMP, currently under development, will ensure consistency in emergency prevention, mitigation, response (including evacuation protocols), and recovery efforts throughout the entire county.

15. *PFAC Operations and Smoke Management Plans* – On an annual basis, a review and revision of each plan will occur.

16. *Development of a PFAC Prevention Plan* – On an annual basis, a comprehensive Prevention Plan, using and incorporating the existing Coconino National Forest plan as a template (see Appendix 6), will be developed to coordinate activities, messages, etc.

17. *Adoption and enforcement of appropriate codes throughout the Greater Flagstaff Area* – Such action will ensure consistency on fire resistive construction, access, water, and addressing requirements, hazard fuel mitigation efforts, etc. (The adoption of the remainder of the Governor's "Arizona Forest Health Advisory & Oversight Councils" recommendations, identified on pg. 53 of this plan, will assist with this need.)

18. *Implement an appropriate monitoring program* – Designed to track both accomplishments and effects of treatments, this will lend credibility to the effort and provide information necessary for the adaptive management of the plan. Perhaps this could be a project for an interested student or volunteer.

19. *Support the USFS in:*
    a) *Encouraging development/use of a Wildland Fire Use Plan for application in appropriate wildland areas,*
    b) *Application of the Appropriate Management Response for area wildfires*
    c) *Planning, preparation, and implementation of prescribed fire projects*

Both GFFP and PFAC can provide leadership and assist with public educational needs to ensure community support of these two items.

Community Mitigation Treatments: The combined effects of fuel reduction treatments implemented through past projects with proposed treatments identified and prioritized in this plan will not create a completely "Fire Safe" community, nor eliminate the need for suppression operations. Due to conditions outside our control, such as drought or extreme weather conditions, no one can guarantee total safety from wildfire. However, this plan is based upon both science and experience, and implementation will greatly reduce fire threat and create a FireWise environment.

Rather than recommending specific treatments, we have chosen to present, as found in Section 3, Desired Future Conditions (p. 37) and general Treatment Guidelines (p. 38-47). Variations of these guidelines have been successfully utilized by property owners and land managers in the area for a number of years.

In this section, we have also chosen to present Treatment-Types utilizing the "coarse-filter" approach and vocabulary available with ForestERA data: We recognize that site-specific planning will need to occur prior to implementation of any treatment, and that the application of tree cutting, prescribed fire, etc, may differ somewhat from that described herein and must reflect silviculturally-accurate methodology and terminology. Factors considered in defining these potential Treatment Types included (see "Treatment Types" in Glossary for definitions of terms):

1. Overall reduction of predicted fire behavior from *Active Crown Fire* to *Passive Crown Fire.* It is extremely difficult to move predicted fire behavior to Surface Fire with just initial treatment unless significant tree removal and pruning, along with surface fuel removal, occurs: even then, individual and small groups of trees may ignite.
2. Treatment action in areas currently rated as Surface Fire will be as follows:
   a) Within the *Interface Zone* → Low Thinning Intensity, (if needed), followed by Light Prescribed Burn (Maintenance).
   b) Outside the *Interface Zone,* but within the *Analysis Area* → Light Prescribed Burn only, unless other factors or objectives dictate the need for Low Intensity Thinning.
3. Protection of wildlife habitat (such as Mexican Spotted Owl and Northern Goshawk), municipal or other critical watersheds (such as Lake Mary and Rio de Flag), and specially designated areas (such as Kachina and Red Rock Secret Mountain Wilderness Areas and San Francisco Peaks and Oak Creek Canyon Research Natural Areas) were considered and included in the analysis.

The exact location of the various potential Treatment Types may need to be slightly adjusted to take advantage of topographic or access features in order to facilitate effective and safe suppression actions when a major fire threatens the area. Adaptive management requires adjustment and refinement as the effort moves forward, and we encourage treatments that have as their goal the reduction of fire risk and the improvement of overall forest ecosystem health.

Five treatment types are recommended - three utilizing mechanical removal of trees followed by prescribed (broadcast) burning, and two burn-only treatments. They include:

Mechanical Thinning Followed by Prescribed Burn:

- **Low Intensity** = Light thinning followed by prescribed fire; representative of a maintenance fuel reduction or light restoration
- **Intermediate Intensity** = Moderate thinning followed by prescribed fire; representative of a moderate fuels reduction or moderate restoration
- **High Intensity** = Heavy thinning followed by prescribed fire; representative of a heavy fuels reduction or full restoration

Prescribed Fire Only:

- **Light Burn** = No mechanical thinning (not required); maintenance burn (one goal is low tree mortality) on sites with light fuels
- **Heavy Burn** = No mechanical thinning (restricted or impractical); thin with fire (one goal is higher tree mortality) on sites with heavy fuels

For additional discussion of these fuel treatments and how they were used in the analysis to modify predicted fire behavior, visit the ForestERA web site.

In addition to vegetation treatments, FireWise building techniques and standards are required. The Uniform Fire Code (UFC) and various Wildland Interface Fire Codes all provide the necessary framework, but not all areas can now adopt such codes based upon population, statutory authority, etc. (This issue is addressed in Section 3 - Improved Protection Capabilities, p. 52.) Currently, within the CWPP area, only the City of Flagstaff has requirements that all new developments implement a Fuel Management program prior to construction and that use of limited-combustible building material is mandatory in selected areas.

Priority Areas and Treatment Costs: The priority area for implementation of appropriate vegetative treatments is the entire *Wildland/Urban Interface* zone (map 5, p. 22). Achieving public safety and community protection through treatment of the most severe fuel accumulations nearest communities are the over-riding objectives. Therefore, within the W/UI priority zone, emphasis should be placed on treating areas of predicted active crown fire behavior adjacent to communities or infrastructure. In addition, anywhere surface fire behavior is predicted, these areas can be treated more quickly and at much lower cost with prescribed fire and may also be emphasized.

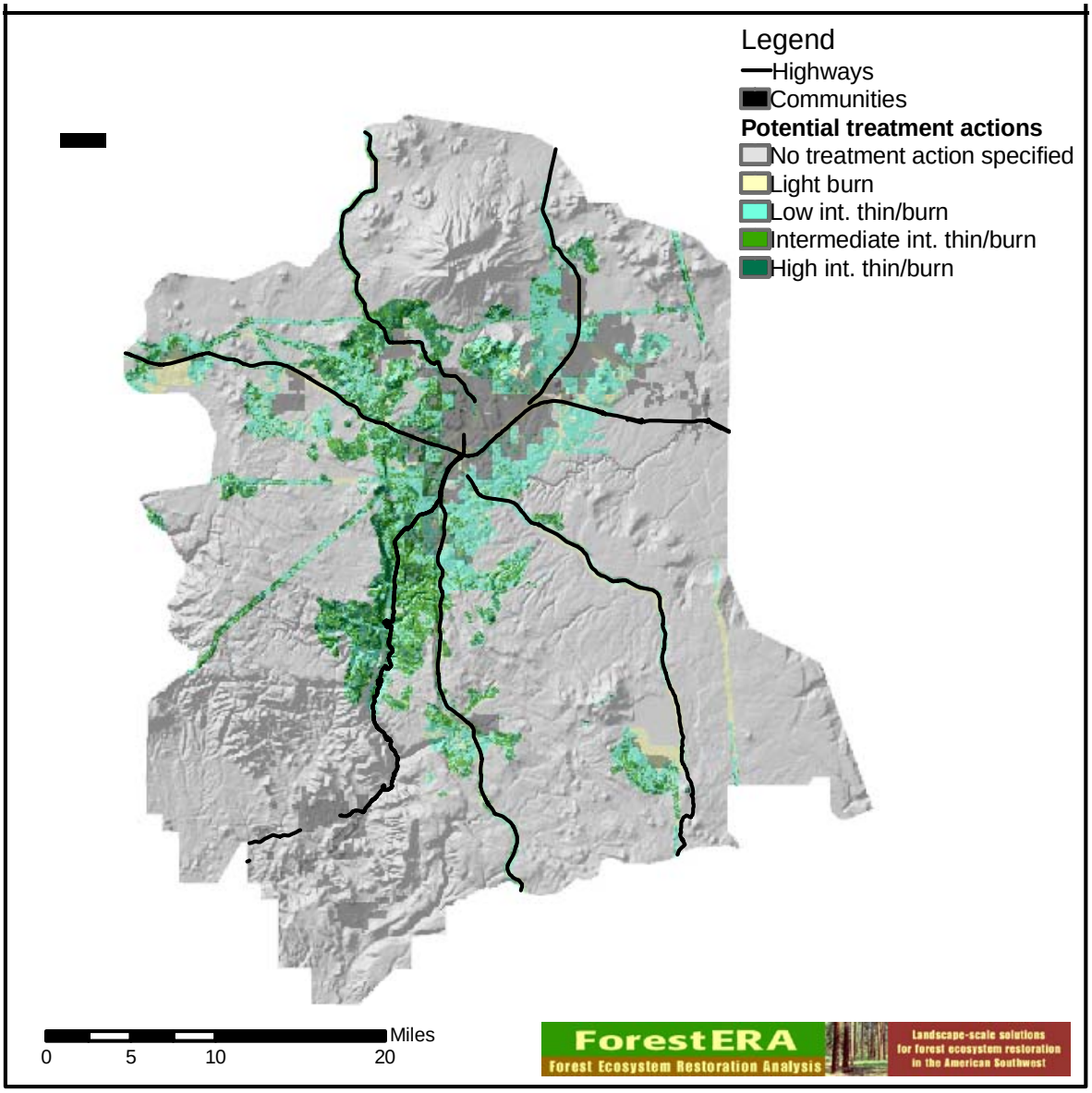
Over the long term, treatment of the remaining acreage within the *Analysis Zone* will need to be implemented. However, sites within this area should reflect other values: public safety may not be the over-riding emphasis, and treatments must reflect those other values and resource management objectives. Opportunities may arise where appropriate treatments within this area are desirable prior to treatments in the *Wildland/Urban Interface*: if this occurs, and the work will not jeopardize priority projects within the W/UI, the opportunity should not be missed. Work in this area will require the JHA to review and refine any treatments in close collaboration with various stakeholders.

Maps 11A (*Wildland/Urban Interface*) and 11B (*Analysis Area*), depict recommended locations of where the treatments should be located. As indicated earlier, development of detailed prescriptions will be the responsibility of the JHA, and must be consistent with statutory authority and applicable land and resource management plans, be based on detailed knowledge of site conditions, and address specific resource management objectives.

Table 8 identifies the acreage of each treatment type within the *Wildland/Urban Interface* and the remaining *Analysis Area* excluding the W/UI. The table also provides an estimate of potential costs associated with applying the recommended treatments to the appropriate acres. Based on best estimates of typical costs associated with planning and implementation of the five treatments in earlier projects, an “average” per/acre cost was determined and applied. This data dramatically illustrates the financial commitment required to treat the recommended acres. This cost demonstrates that from a strategic perspective, small-diameter wood-based enterprise development (including infrastructure development, wood utilization technology, sustained supply, and sufficient capital for business establishment and operating), all geared toward the establishment of a sustainable and effective industry that can offset some of the costs associated with hazardous fuel treatment, is critical if we are to succeed.

Needed capital can take many different forms: subsides, low-interest loans, cost-share, profit-sharing ventures, and direct payments. Funding sources may include numerous federal, state, local government, and private corporation ventures, and should include the entire gamut: planning, design, implementation, and monitoring.

MAP 11A

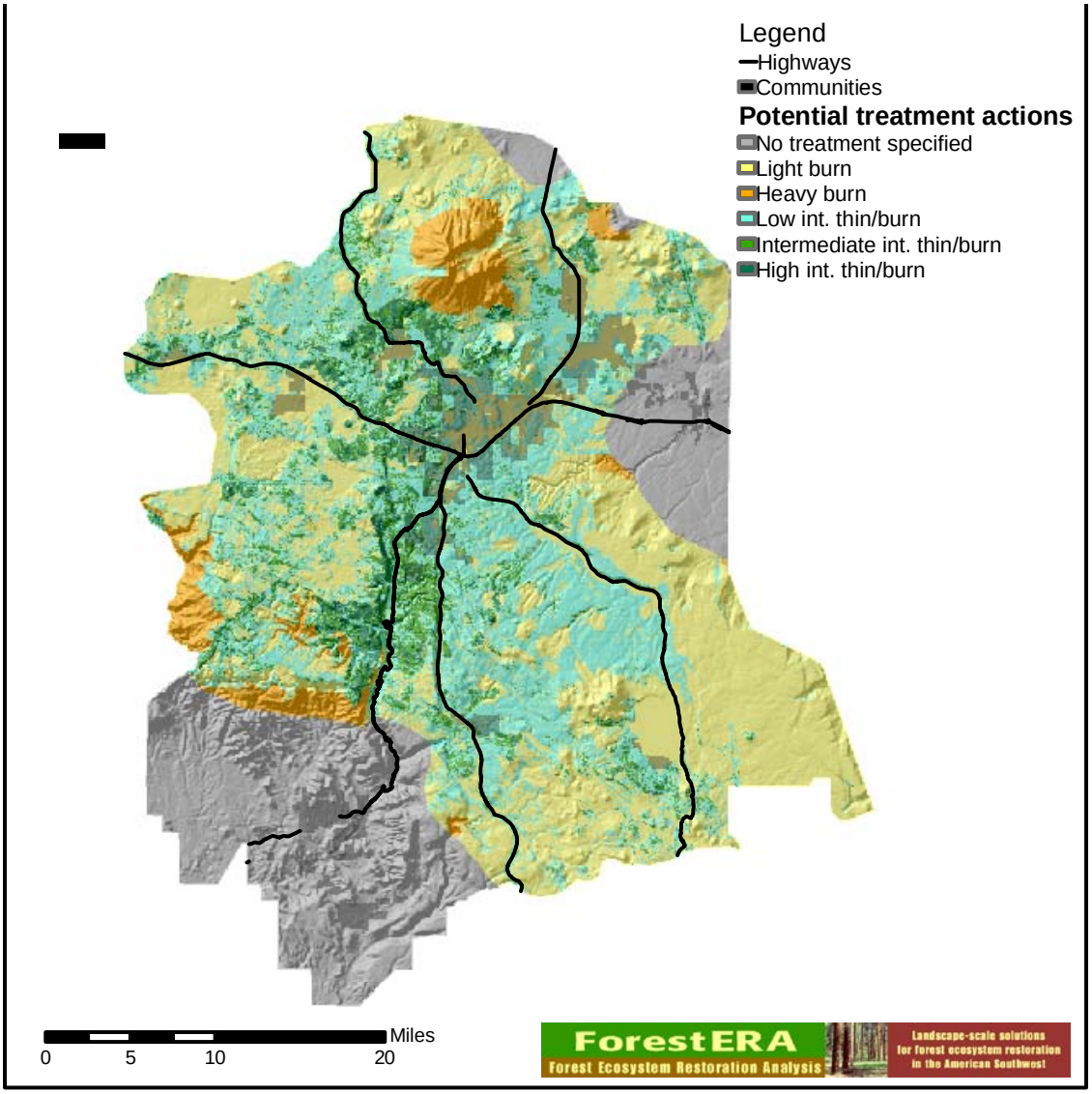


CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

WILDLAND/URBAN INTERFACE - POTENTIAL TREATMENT TYPE

(Requires Site-Specific Analysis and Refinement)

MAP 11B



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

ANALYSIS AREA - POTENTIAL TREATMENT TYPE

(Requires Site-Specific Analysis and Refinement)

Table 8
Acreage & Estimated *Initial* Treatment Costs

POTENTIAL TREATMENT TYPE

LOCATION	Low Intensity Thin	Intermediate Intensity Thin	High Intensity Thin	Light Burn	Heavy Burn	TOTAL
Wildland/Urban Interface						
Acres	97,693	45,930	21,191	32,519	0	197,333
Cost ($)	$63.5 M	$36.7 M	$21.2 M	$2.4 M	0	$123.8 M
Analysis Area Less W/UI						
Acres	164,420	15,979	104	318,030	43,429	541,962
Cost ($)	$106.9 M	$12.8 M	$0.1 M	$23.4 M	$5.4 M	$148.6 M
ACRES *	**262,113**	**61,909**	**21,295**	**350,549**	**43,429**	**739,295**
COST ($)	**$170.4 M**	**$49.5 M**	**$21.3 M**	**$25.8 M**	**$5.4 M**	**$272.4 M**

***** *No treatment specified on 200,441 acres of Analysis Area due to lack of data*

Estimated Treatment Types Costs:

Thinning Intensity:
Low = $650/acre
Intermediate = $800/acre
High = $1000/acre

Prescribed Burn:
Light = $75/acre
Heavy = $200/acre

NOTES:
1) Costs shown above are **for initial treatment only**; an annual maintenance budget will be required
2) Estimates include planning costs.
3) Total **Acres** and **Cost ($)** are low as the above figures do not reflect areas (200,441 acres) where ForestERA data does not exist (ex: Sedona, Cosnino/Winona)

Predicted Treatment Effects: When proposed treatments are applied to the appropriate acres as recommended in this plan, the ForestERA model is capable of predicting and displaying potential effects on fire behavior resulting from treatment. Maps 12A and 12B depict the response of fire behavior to implementing the recommended treatments in the *Wildland/Urban Interface* and in the entire *Analysis Area*. Although these are predicted effects, it does serve to illustrate the potential impacts of fuel reduction treatments on one of the parameters of most concern in protecting communities from catastrophic wildfire. For comparison purposes, Map 13 presents three maps side by side: predicted fire behavior under current conditions, predicted fire behavior after all recommended treatments are implemented in the *W/UI*, and predicted post-treatment fire behavior in entire A*nalysis Area*. Table 9 provides acreage and percent change in predicted fire behavior based on these maps.

Monitoring and Assessment Plan: In our efforts to reduce the threat of uncharacteristic wildfire to communities and restore fire to fire adapted ecosystems, we recognize that we do not fully understand the consequences of all management options. Similarly, we do not yet fully realize or appreciate the consequences of traditional treatment options in all areas or ecosystems. In the face of uncertainty regarding the social, ecological, economic, and actual fire behavior changes as a result of fuels reduction efforts, and the concomitant potential "slowing down" of projects due to stakeholders' concerns, appeals, and lawsuits, it is imperative that a targeted, efficient and effective monitoring program be integrated into land management actions. However, to best use the information gathered by such monitoring efforts, it is also imperative that we, as stewards of the land, use a decision making process that is adaptive, or able to alter the course of actions based on the best available information. This is what is intended by the process of *adaptive management*.

To coordinate tracking and monitoring of the implementation of this CWPP, a Review Team should be established to include, at a minimum, representatives from GFFP, PFAC, Forest ERA, the USFS, local government, the environmental community, and citizens at large. Initiating activities right after formal approval of the CWPP and utilizing input from various sources, the Review Team should evaluate and report on the accomplishments and challenges in meeting the overall goal of this plan:

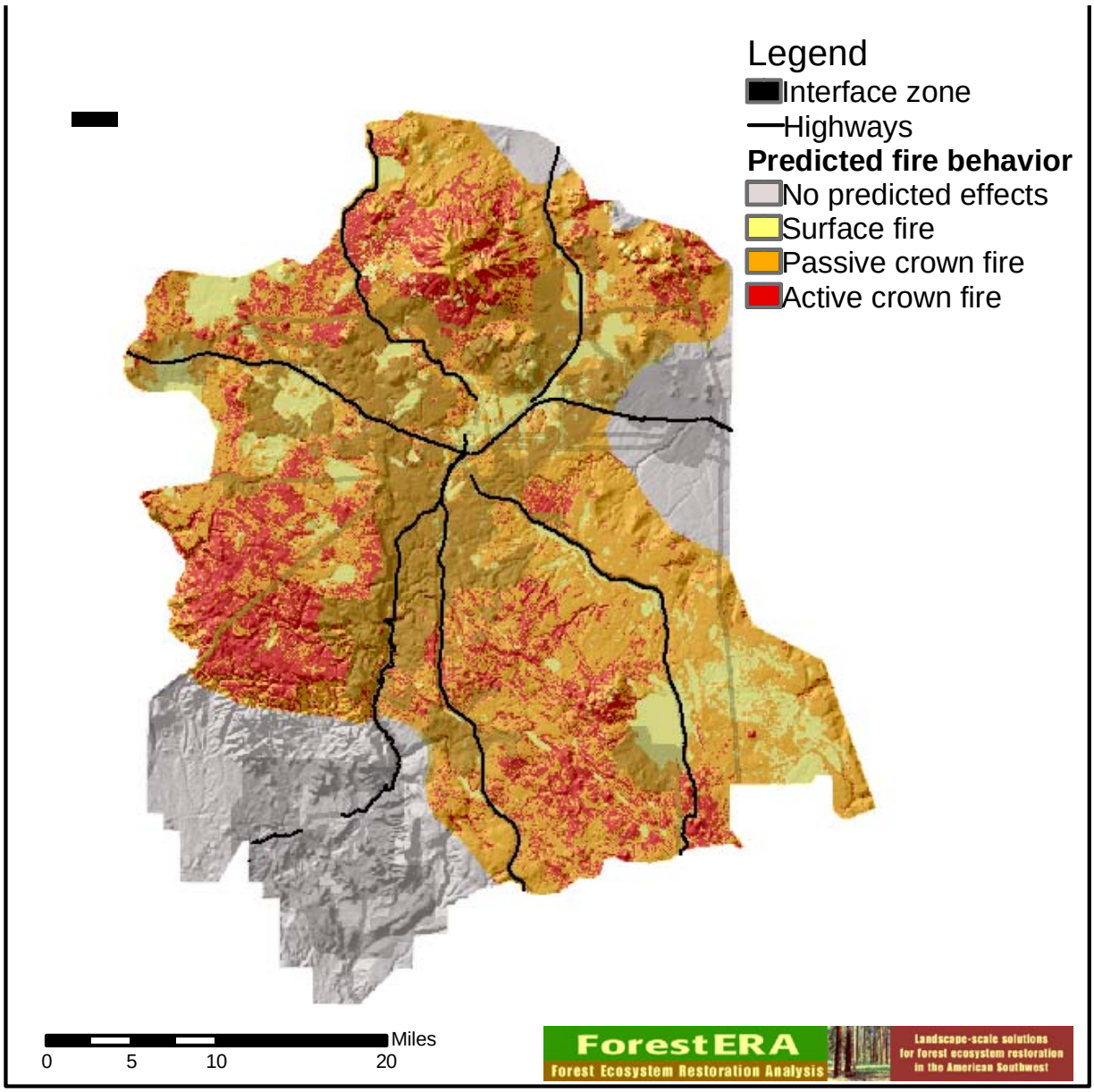
To protect Flagstaff and surrounding communities, and associated values and infrastructure, from catastrophic wildfire by means of:

a) *An educated and involved public,*

b) *Implementation of forest treatment projects designed to reduce wildfire threat and improve long-term forest health, in a progressive and prioritized manner, and*

c) *Utilization of FireWise building techniques and principles.*

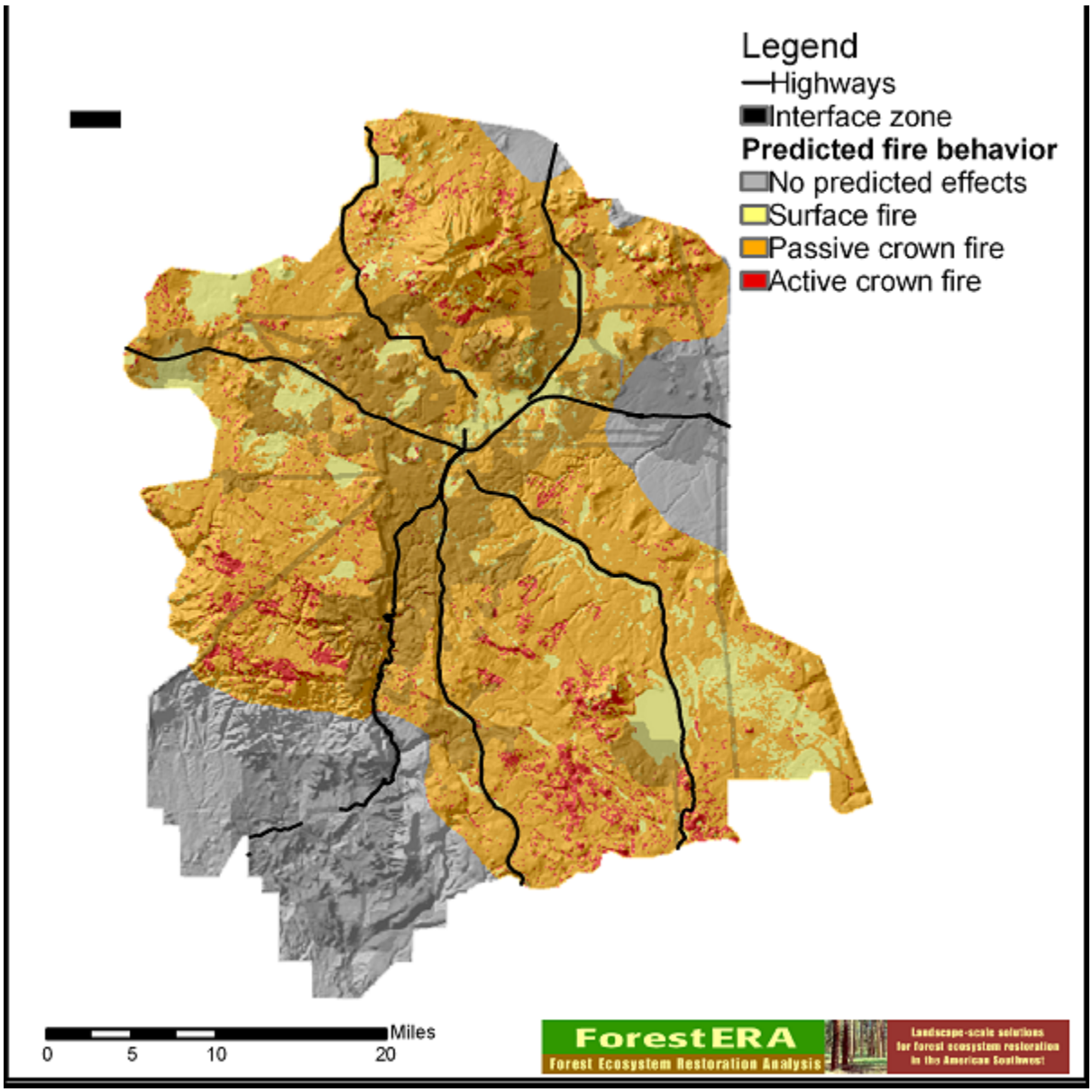
MAP 12A



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

WILDLAND/URBAN INTERFACE – PREDICTED POST-TREATMENT EFFECTS ON FIRE BEHAVIOR

MAP 12B



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

ANALYSIS AREA – PREDICTED POST-TREATMENT EFFECTS ON FIRE BEHAVIOR

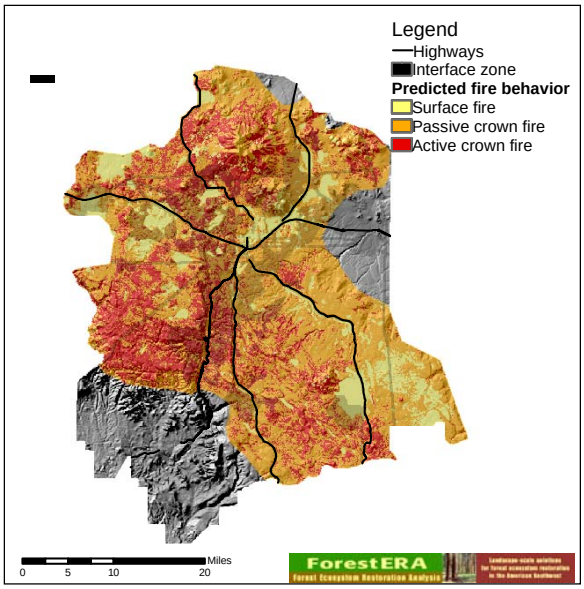
Table 9

Post Treatment Predicted Fire Behavior

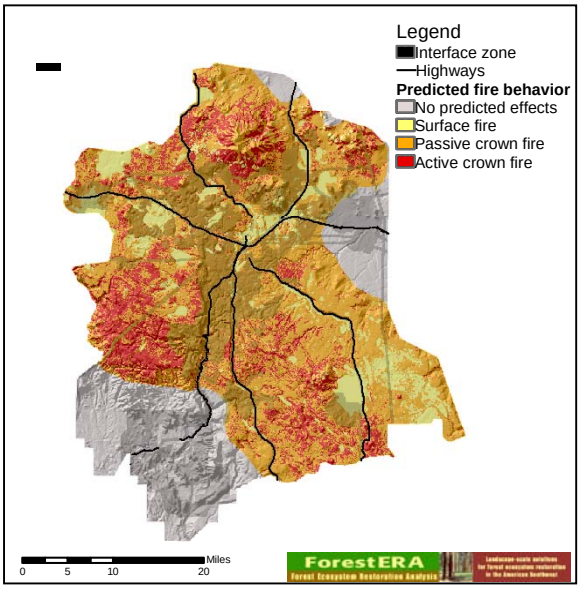
Location	**Fire Behavior**	**Pre Treatment Acres**	**Post Treatment Acres**	**% Change of Total**
W/UI	Active	68,248	3,606	- 94%
	Passive	105,353	169,834	+ 61%
	Surface	23,757	25,765	+ 8%
	No Prediction	0	0	0%
Analysis Area	Active	150,933	47,610	- 69%
(Less W/UI)	Passive	314,929	416,405	+ 32%
	Surface	75,450	75,450	0%
	No Prediction	201,066	201,066	0%
TOTAL ACRES		**939,736**	**939,736**	

MAP 13

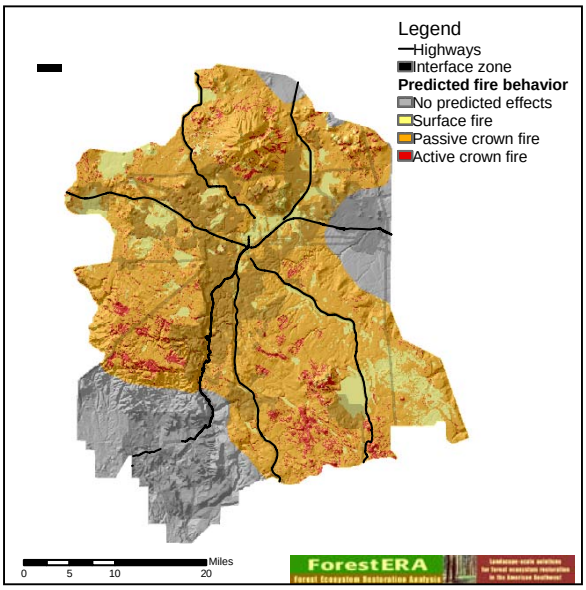
A



B



C



CWPP FOR FLAGSTAFF & SURROUNDING COMMUNITIES

COMPARISON OF PRE-TREATMENT AND POST-TREATMENT FIRE BEHAVIOR

Map A shows predicted fire behavior under current conditions. Map B shows predicted fire behavior if all potential treatment actions were to be implemented within the *Wildland/Urban Interface* zone. Map C shows predicted fire behavior if all potential treatment actions were to be implemented within the *Analysis Area*.

It is proposed that the Review Team also be tasked with designing and coordinating implementation of a multi-party monitoring program to acquire real data with which to accomplish their evaluation and reporting activities and implement adaptive management. The monitoring program will need to address diverse areas such as fuel reduction and fire behavior, ecosystem restoration, ecological impacts, and social and economic issues, and should be based on existing monitoring protocols. A framework of goals, objectives, and measurement methods, such as the *"GFFP Monitoring & Research Teams Adaptive Management Framework"* and which is included as Appendix 9, should be considered for inclusion in CWPP projects, based on the management objectives and potential impacts of each project. Not every project will have the same degree of uncertainty, and not every project has the same number of factors that are potentially impacted. The Review Team (or other appropriate body) may need to assess each project, and decide the level of monitoring that should be accomplished based on site-specific details, management objectives specific to existing conditions, desired future conditions, and the management options available to accomplish those objectives.

All CWPP projects must allocate funds to accomplish monitoring (approximately 5-10% of project costs is a target), and establish a formal process for integrating the results of that monitoring through time back into the land management decision-making process. One of the major benefits of monitoring projects and the cumulative effects of projects at the landscape level is that the process serves as a tremendous tool for public education and involvement, and as we learn from our failures and successes, there is greater agreement about how to proceed into the future.

At a minimum, each of the three items in the goal above will be evaluated based upon the four criteria described below. Not all may be applicable for each item, and additional criteria may be added. They include:

a. Implementation – A crucial aspect of measuring success will be actual implementation of needed treatments: Did they occur and in what locations? Treatment Maps (For example: Map 8, p. 29) will be updated annually and shared with the community and all responsible parties.
b. Effectiveness – Of equal importance is the question of how effective are the various treatments: Have they done what was anticipated in terms of fire risk reduction? Where possible, pre-and-post treatment fuel transects will be inventoried to determine actual change in fuel amounts. Fire affects from subsequent wildfires will be evaluated to refine future treatments and the results shared with the community.
c. Ecological Impacts – We continue to need a better understanding of how fuels reduction and forest restoration actions affect the plants, animals, soils, watersheds, and ecosystems within project areas. If we are to be successful in *restoring* forests, we must understand the ecological effects of our various restoration strategies and actions, both at the project scale, and at the landscape scale.

d. Social Monitoring – Public attitudes toward both on-going and proposed treatments, and the agencies/organizations promoting and implementing them, is critical to success. Assessment of these attitudes will be on-going, and will include review of the following indicators:
   - *Editorials and other media coverage*
   - *Letters to editor*
   - *Requests for assistance*

   At some point, it may be beneficial to engage the Behavioral Sciences Lab at Northern Arizona University (or another source) to conduct a scientific poll or survey to further refine treatments and guide education and planning efforts.

e. Economic Impacts - If we are to achieve success, a sustainable utilization component is essential. Of importance will be the success in attracting viable small diameter wood-based businesses into the area and evaluating their resulting economic impact. Once in place, evaluation of this aspect will be coordinated with the Greater Flagstaff Economic Council.

The Review Team should hold their initial meeting as soon as the CWPP is approved and establish a process to help facilitate implementation of the plan among the various land management agencies and to design and implement the monitoring program. A formal convening of the Team should also be scheduled for six months after adoption of the CWPP to complete a comprehensive review of the Plan and develop any recommended revisions. Thereafter, the Team should meet at least annually to review progress and make recommendations for appropriate revisions to the document.

Roles and Responsibilities of Stakeholders: As depicted on Table 10, successful implementation of the CWPP cannot be done without major cooperation from all. Without continued collaboration and mutual assistance, this plan will only provide a false sense of security. Wildfire does not recognize property boundaries, and neither can we.

Table 10
Roles and Responsibilities of Key Stakeholders

Stakeholder	Planning Design Implementation	Education Information Transfer	Advisory	Regulatory Permitting
Private:				
Citizens	X	X		
Businesses	X	X	X	
Service Clubs	X	X		
Homeowner Groups	X	X		X
City:				
Officials/Departments	X	X	X	X
Fire Departments	X	X	X	X

County:				
Officials/Departments	X	X	X	X
Fire Districts	X	X	X	X
Rural Environmental Conservation Corps	X	X		
State:				
Dept of Emergency & Military Affairs (Camp Navajo)	X	X	X	
Land Dept – Fire Management	X	X	X	
Dept of Transportation	X			
Dept of Corrections	X			
Game & Fish Dept	X	X	X	X
Dept of Environmental Quality		X	X	X
Cooperative Extension Service	X	X	X	
Northern AZ University:				
Ecological Restoration Institute	X	X	X	
School of Forestry		X	X	
Forest ERA	X	X	X	
Centennial Forest	X	X		
Federal:				
Naval Observatory	X			
Forest Service	X	X	X	X
Fish & Wildlife Service	X	X	X	X
National Park Service	X	X	X	
Other:				
Utilities –				
El Paso Natural Gas		X	X	
AZ Public Service	X	X	X	
Greater Flagstaff Forests Partnership	X	X	X	
Ponderosa Fire Advisory Council	X	X	X	

Assistance

Development of the CWPP is a new initiative established under the HFRA of 2003. Since very few communities have completed plans – per guidelines set forth by the National Association of State Foresters, Communities Committee of the Seventh Forest Congress, Society of American Foresters, National Association of Counties, and Western Governors' Association – reference material from other communities or groups regarding both specific plan content and process was limited. Nonetheless, we believe we have developed a community supported CWPP that meets the intent of the HFRA.

Important documents utilized during development of this plan include:

"*Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities*"
(www.safnet.org/policyandpress/cwpp.cfm)

"*Federal Agency Implementation Guidance for the Healthy Forest Initiative and the Healthy Forests Restoration Act*"
(www.fs.fed.us/projects/hfi/field-guide)

"*Field Guidance for Identifying and Prioritizing Communities at Risk*"
(www.stateforests.org/reports/COMMUNITIESATRISK.pdf)

Several websites also provided valuable information. They include:

Arizona Cooperative Extension Service (http://ag.arizona.edu/extesion/fh/)

Arizona Fire Management Division (www.azstatefire.org)

Arizona FireWise Communities (www.cals.arizona.edu/firewise)

Arizona Forest Health Council (www.governor.state.az.us/FHC/)

Forest Ecosystem Restoration Analysis Project (ForestERA)
(www.forestera.nau.edu)

Flagstaff Fire Department (www.flagstaff.az.gov/fuelmanagement)

Fire Safe Council (www.firesafecouncil.org)

Grants: Foundation (www.fdncenter.org)

Federal (www.grants.gov)

Greater Flagstaff Forests Partnership (www.gffp.org)

Northern Arizona University Forest Health (www.forestfire.nau.edu/)

Southwest Area Fire & Drought (www.swstrategy.org/fire.html)

The National Fire Plan (www.fireplan.gov)

Western Governor's Association (www.westgov.org)

For recommendations regarding treatments and/or site-specific FireWise information, contact:

AZ State Land Department	-	928-774-1425
Flagstaff Fire Department	-	928-779-7688
Highlands Fire District	-	928-525-1717
Mormon Lake Fire District	-	928-
Parks-Bellemont Fire District	-	928-635-5311
Pinewood Fire District	-	928-286-9885
Sedona Fire District	-	928-
Summit Fire District	-	928-526-9537

For information regarding specifics of this plan, contact either of the following:

Paul Summerfelt	Steve Gatewood
FMO-Flagstaff Fire Depatment	Program Director - GFFP
211 W. Aspen	1300 S. Milton #218
Flagstaff AZ 86001	Flagstaff AZ 86001
(928) 779-7685 x 7283	(928) 226-0644
psummerfelt@ci.flagstaff.az.us	steveg@gffp.org

GLOSSARY

Glossary terms come from several sources including:

> Arizona Forest Health Advisory Council. 2003. *Guiding Principles for Forest Ecosystem Restoration and Community Protection*. September 2003.
>
> Ecological Research Institute. 2004. *Western Mogollon Plateau Adaptive Landscape Assessment Draft Report on Initial Workshop Outcomes*. June 2004

Basal Area (BA): The area of the cross-section of a tree trunk near its base, usually 4½ feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective basal area of trees per acre.

Biodiversity (biological diversity): The variety of life and its process, including the variety in genes, species, ecosystems, and the ecological processes that connect everything in the ecosystem.

Coarse-filter analysis: An analysis of aggregates of elements such as cover type or plant community.

Community protection: Actions or programs undertaken for the purpose of protecting human lives, property, and infrastructure.

Conservation: The careful protection, utilization and planned management of living organisms and their vital processes to prevent their depletion, exploitation, destruction, or waste.

Critical habitat: According to Federal Law, the ecosystem upon which endangered and threatened species depend.

Crown fire: This is a fire that travels from one crown (or tree top) to another in dense stands of trees, killing most trees in its path. However, even in intense crown fires, unburned strips may be left due to powerful, downward air currents. A passive (or dependent) crown fire relies upon heat transfer from a surface fire burning below crowns. An active (or independent) crown fire does not require transfer of heat from below the crowns,

Defensible space: This is the area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure. It also reduces the chance of a structure fire moving from the building to the surrounding forest. Defensible space provides room for the firefighters to do their jobs. Many communities are taking a more holistic approach of creating defensible neighborhoods rather than jus individual properties.

Disturbance: A discrete event, either natural or human induced, that causes a change in the existing condition of an ecological system.

Ecosystem: Living organisms interacting with each other and with their physical environment, usually described as an area for which it is meaningful to address these interrelationships.

Ecological restoration: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Fire Behavior: As utilized throughout this plan -

Active Fire Behavior = Fires readily transition into tree crowns, with large group tree torching common: associated long-range (≥ .5 mile) spotting is common

Passive Fire Behavior = Fires will transition into tree crowns, but only small-group or individual tree torching common: associated long-range spotting (≥ .5 miles) can occur

Surface Fire Behavior = Fires stay on the ground, with little tendency to transition into tree crowns except in isolated cases: short-range spotting (≤ ¼ mile) can occur

Fire Frequency (Fire Return Interval): How often fire burns a given area; often expressed in terms of fire return intervals (e.g., fire returns to a site every 5-15 years). (see also Fire Regime Group).

Forest ecosystem health: A condition where the parts and functions of an ecosystem are sustained over time and where the system's capacity for self-repair is maintained, allowing goals for uses, values, and services of the ecosystem to be met.

Forest ecosystem restoration: Holistic actions taken to modify an ecosystem to achieve desired, healthy, and functioning conditions and processes. Generally refers to the process of enabling the system to resume acting, or continue to act, following the effects of a disturbance. Restoration management activities can be active (such as control of invasive species, thinning of over-dense tree stands, or redistributing roads) or more passive (more restrictive, hands-off management direction that is primarily conservation oriented). Frequently, a combination or number of actions is used sequentially to achieve restoration goals.

Hazard: To place something of value in a risky or dangerous situation

Hazardous fuel: Excessive live and dead trees and other vegetation and organic debris that increase the potential for uncharacteristically intense wildland fire and decrease the capability to protect life, property, and natural resources.

Healthy ecosystem: An ecosystem in which structure and functions allow the maintenance of the desired condition of biological diversity, biotic integrity, and ecological processes over time.

Old growth tree; This is an old tree, one that exhibits the complex structural characteristics associated with the oldest age class of trees in a group, clump or stand. In today's forests, an old growth tree in one that has been present since before the onset of commercial logging and fire exclusion. These trees are sometimes referred to as pre-settlement trees. These trees typically have orange or yellow platy bark.

Prescribed fire: A management fire ignited to meet specific fuel reduction or other resource objectives. All prescribed fires are conducted in accordance with prescribed fire plans.

Risk to communities: The risk associated with adverse impacts to communities resulting from unwanted wildfire.

Reference conditions: Conditions characterizing ecosystems composition, structure, and their variability.

Restoration: Actions taken to modify an ecosystem in whole or in part to achieve a desired condition.

Surface fire: A fire that burns over the forest floor, consuming litter, killing aboveground parts of herbaceous plants and shrubs, and typically scorching the bases and crowns of trees.

Sustainability: The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

Threat: An indication that an undesirable event or catastrophe may occur. For this plan, a Threat matrix, using three items, was developed to permit focus upon the Interface Zone.

Value – The measure of how strongly something is desired, expressed in terms of effort, money, etc one is willing to expend to attain or preserve it. Two issues (Communities and Infrastructure, and Municipal Watersheds) were identified in this plan.

Risk – The possibility of danger, injury, or loss. Two issues (Predicted Fire Behavior and Post-Fire Flooding) were identified in this plan.

Other – Further or additional issues. One item (Areas upwind from at-risk communities (permitting fire spread into at-risk communities) was identified in this plan.

Treatment Types (potential): These are general descriptor terms only, not silvilcultural terms- *Thinning Intensity*:

Low = Simple thinning, w/prescribed fire
Intermediate = Moderate thinning, w/prescribed fire
High = Heavy thinning w/prescribed fire

Prescribed Fire only (Rx):

Light = No mechanical thinning: maintenance burn (one goal is lower tree mortality) or sites w/light fuels (less intense fire)
Heavy = No mechanical thinning (required or practical): thin with fire (one goal is higher tree mortality) or sites w/heavy fuels (more intense fire

Watershed: An area of land with a characteristic drainage network that contributes surface or ground water to the flow at that point: a basin or a major subdivision of a drainage basin.

Wildland fire use: The management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in pre-defined geographic areas outlined in Fire Management Plans.

Appendix 1

GFFP and PFAC Membership

GFFP PARTNERSHIP ADVISORY BOARD MEMBERS – September 2004

Arizona Game & Fish
Arizona Public Service
Arizona State Land Department – Fire Management Division
City of Flagstaff – Fire Department
Coconino County – Community Development Department
Coconino County Farm Bureau / Cattle Growers Association
Coconino Natural Resource Conservation District
Coconino Rural Environment Corps
Cocopai Resource Conservation & Development District
Ecological Restoration Institute at Northern Arizona University
Flagstaff Chamber of Commerce
Flagstaff Native Plant & Seed
Grand Canyon Trust
Greater Flagstaff Economic Council
H & K Consulting
Highlands Fire District (Communities of Kachina Village, Forest Highlands and Mountainaire)
Indigenous Community Enterprises
Northern Arizona University - College of Engineering
Northern Arizona University - School of Forestry
Perkins Timber Harvesting
Ponderosa Fire Advisory Council
Practical Mycology
Southwest Environmental Consultants
Society of American Foresters - Northern Arizona Chapter
The Arboretum at Flagstaff
The Nature Conservancy
US Fish and Wildlife Service
Cooperators
USDA Coconino National Forest
USDA Rocky Mountain, Pacific NW and Southern Research Stations
USDA Forest Products Lab

PONDEROSA FIRE ADVISORY COUNCIL MEMBERS – September 2004

Arizona State Land Department
Camp Navajo Fire Department
Coconino County Emergency Services
Coconino National Forest
Coconino Sheriff Department
Flagstaff Fire Department
Flagstaff Police Department
Flagstaff Ranch Fire Department
Highlands Fire Department
Kaibab National Forest
Mormon Lake Fire Department
Parks/Bellemont Fire Department
Pinewood Fire Department
Sedona Fire Department
Summit Fire Department
Walnut Canyon-Wapatki-Sunset Crater National Monuments

Appendix 2

Guiding Principles for Forest Restoration and Community Protection

GUIDING PRINCIPLES FOR FOREST ECOSYSTEM RESTORATION AND COMMUNITY PROTECTION

Arizona Forest Health Advisory Council
September 2003

Steve Campbell ~ Navajo County Cooperative Extension
Dr. Wally Covington ~ Northern Arizona University Ecological Restoration Institute
Dr. Carl Edminster ~ USDA Forest Service Rocky Mountain Research Station
Lori Faeth ~ State of Arizona
Don Falk ~ University of Arizona Laboratory of Tree-Ring Research
Deb Hill ~ Coconino County
John Kennedy ~ Arizona Game and Fish Department
Robert Lacapa ~ Bureau of Indian Affairs
Taylor McKinnon ~ Grand Canyon Trust
Dr. Marty Moore ~ Eastern Arizona Counties Organization
Brian Nowicki ~ Center for Biological Diversity
Kirk Rowdabaugh ~ Arizona State Land Department
Karl Siderits ~ USDA Forest Service Tonto National Forest
Ed Smith ~ The Nature Conservancy
Dr. Tom Swetnam ~ University of Arizona Laboratory of Tree-Ring Research
Richard Van Demark ~ Southwest Forestry
Beth Zimmerman ~ Arizona Division of Emergency Management

Preamble to the Guiding Principles

Arizona's high country is home to magnificent forests harboring a diversity of biological, cultural, and economic values. Yet many of Arizona's forests—especially Arizona's extensive ponderosa forests—have undergone a dramatic transformation during the past century due to land use, climate, and other factors. These changes have increased insect and disease outbreaks, abnormally severe fires, and adversely affected biological, cultural, and economic values. The unacceptable risk posed by these conditions requires immediate and strategic action.

Recognizing these factors, Arizona Governor Janet Napolitano convened a Governor's Conference on Forest Health and Safety in March 2003. Findings from this conference led to the development of an Action Plan for Arizona, and a call for the creation of a broad, science-based Forest Health Advisory Council to provide recommendations on how to improve the health of Arizona's forests.

The Arizona Forest Health Advisory Council has developed these Guiding Principles to provide an overall framework for planning and implementing forest ecosystem restoration and community protection projects statewide. In presenting these Guiding Principles, the Council emphasizes the following:

Different forest types have different natural disturbance regimes. For example, where crown fire is unnatural, thinning and prescribed burning may be needed to safely reestablish more natural surface fire regimes. But in forest types where crown fire is natural, such treatments may not be needed, at least from an ecological standpoint.

Understanding these differences is fundamental to restoring more natural disturbance regimes in our forests.

Community stakeholders must take the lead to implement these principles and make the decisions for their communities at risk. The Council stresses the immediate and urgent need to adequately reduce the risk to communities. This will require a comprehensive effort to reduce hazardous fuels in and around at-risk communities regardless of the adjacent ecosystem type. Fire research and recent fires demonstrate that fuels reduction treatments in and around communities may not prevent the loss of homes. Homeowners must do their part to create defensible space and replace or mitigate flammable building materials.

Although Arizona's forest and woodland ecosystems need restoration, it is important to understand that restoration is a young science whose long-term outcomes are uncertain. The Council urges employing a diversity of restoration strategies that fit local ecological, social, political, and economic circumstances. A "one size fits all" approach is not appropriate.

Learning about restoration should be an active and ongoing process. A serious commitment to monitoring and adaptive management is critical to understanding the ecological, social, and economic dimensions of restoration. The Guiding Principles should be viewed as dynamic and adaptable to evolving conditions and experiences.

The costs of restoration must be weighed against the costs of inaction. Though restoration may seem a weighty investment, it pales in comparison to the immediate and long-term costs and risks of allowing current forest conditions to persist. Restoration is a process of recovery requiring a substantial and sustained investment of funds, and political and public support.

The Guiding Principles urge us to think big. Arizona's forests and the ecological processes that sustain them span landscapes. Assessing needs, identifying priorities, and charting progress toward community protection and forest ecosystem restoration goals must occur within an appropriately large landscape context.

The Council's ultimate hope is that the Guiding Principles will help guide our movement toward sustainable and reciprocal relationships between human communities and forest ecosystems – relationships that sustain the biological, cultural, and economic values that contribute to a healthy democratic society, both now and into the future.

Guiding Principles

Integration

The overall strategy for restoring forest ecosystem health and protecting communities must be dynamic, comprehensive and integrated. A primary component of the overall strategy is to perform a statewide forest health evaluation to identify high-priority communities, critical infrastructure, habitats, and watersheds at risk. This evaluation can also provide the framework for monitoring individual projects and cumulative effects.

Sustainable Communities and Economies

Sustainable economies are linked to sustainable ecosystems. We should be building a sustainable future for Arizona's forests and communities

The immediate focus should be on protecting human communities at risk, critical infrastructure, along with key watersheds and habitats. Distinguishing between forest ecosystem restoration and community protection, and focusing on community protection within the entire community—private, public and tribal lands and the wildland-urban interface—will improve the likelihood of success.

Close collaboration among all stakeholders is essential to a community-based approach to forest ecosystem restoration and community protection. Encourage and empower community-based collaborations to demonstrate and implement effective community protection and forest ecosystem restoration. Be sensitive and responsive to the diversity of individuals and communities who value and/or depend on the forest and its resources.

Decision-making about forest ecosystem restoration and community protection must occur with a serious commitment to rigorous adaptive management. Such an approach should include baseline data, short and long-term monitoring, and a transparent mechanism for tracking results, evaluating and incorporating findings into the decision-making process.

Ecological Integrity

Appropriate restoration methods are based on ecological need. These methods are further defined by the importance of the site in the watershed or landscape, and the timing, techniques and resources needed to restore ecological integrity. Restoration needs to be designed with a clear understanding of desired and ecologically appropriate future conditions.

Effective forest ecosystem restoration should reestablish fully functioning ecosystems. A primary goal of forest restoration is to enhance ecological integrity, natural processes and resiliency to the greatest extent possible. Fire hazard reduction must be linked to the reintroduction of fire as a keystone ecological process. An active program of prescribed and maintenance burns and natural fire use is essential.

Forest ecosystem restoration and community protection treatments should protect and enhance water and soil resources. The development and implementation of forestry best management practices will serve to protect these resources.

Forest ecosystem restoration should protect and promote development of old-growth trees and large trees needed to restore ecosystem structure and function.

Landscape scale forest ecosystem restoration should maintain native plant and wildlife populations and habitat features. A key consideration is the need to maintain and restore movement corridors and refugia to avoid biodiversity bottlenecks.

Project work should be based upon landscape assessments of risks to and status of aquatic and terrestrial resources and of the potential for restoration to be successful. The assessment is used to identify the root causes of ecosystem degradation at the eco-regional, intermediate and site level scales, determine appropriate methods for restoring degraded systems and create a spatially-explicit prioritization of restoration needs.

Land Use and Planning

Forest ecosystem restoration must include evaluating and changing public land use practices that are scientifically demonstrated to contribute to forest health degradation.

Forest ecosystem problems and solutions exist in a context of land use. In fire prone areas community officials must develop, adopt, and enforce comprehensive land use plans, zoning regulations and building codes for community protection, forest restoration, ecosystem health requirements and long-term fire management. Zoning and land use have a major impact on fire management, and can make a significant contribution to restoring forest health and protecting communities.

Forest ecosystem restoration requires effective community protection to establish and maintain a fire-resistive condition for structures, improvements and vegetation. Methods for accomplishing this condition are based on public safety needs, fire hazard, and local capability and creativity. A fire-resistive condition will be accomplished by removing and modifying forest fuels, establishing defensible space, and use of fire-resistant construction materials and architectural design.

Funding and Compliance

Forest ecosystem restoration and community protection requires a sustained investment of federal, tribal, state, local and private resources. Restoration is a long-term process requiring a sustained commitment of funding. Adequate, sustained investment in forest ecosystem restoration and community protection is more cost effective and socially desirable than fire suppression and rehabilitation.

Forest ecosystem restoration and community protection actions should comply with all applicable environmental laws and regulations.

Practices

Forest ecosystem restoration and community protection programs should use the lowest impact techniques that will be effective and efficient. Explore, develop and utilize low impact technologies to sustain and enhance ecosystem integrity and productivity, and minimize negative cumulative effects.

All forest ecosystem restoration and community protection treatments should use locally adapted native plant materials to the greatest extent possible. Non-invasive, non-native species may be considered for emergency rehabilitation.

GLOSSARY

Adaptive Management
A type of natural resource management in which decisions are made as part of an ongoing process. Adaptive management combines planning, implementing, monitoring, research, evaluating, and incorporating new knowledge into management approaches based on scientific findings and the needs of society. Results are used to modify future management methods and policy.

Biodiversity
The variety of life forms and processes including complexity of species, communities, gene pools, and ecological functions.

Biodiversity Bottleneck
A bottleneck in this context is the assemblage of environmental and/or human-caused factors or ecological "threats" that hamper the ability of ecosystems to support biodiversity at its current level through time. The bottleneck analogy is that fewer organisms (and their genes) in the bottle (current conditions) may be able to emerge on the other side (future conditions) due to resource limitations. (Source: this council.) http://www.usembassy.it/file2001_04/alia/a1041704.htm; http://www.clat.psu.edu/biodiversity/defined/populations/populations-p04.html

Community Protection
Actions or programs undertaken for the purpose of protecting human lives, property, and infrastructure. (Source: this council)

Crown fire
This is a fire that travels from one crown (or treetop) to another in dense stands of trees, killing most trees in its path. However, even in intense crown fires, unburned strips may be left due to powerful, downward air currents. A passive (or dependent) crown fire relies upon heat transfer from a surface fire burning below the crowns. An active (or independent) crown fire does not require transfer of heat from below the crowns. Source: Barnes, Burton V., Donald R. Zak, Shirley R. Denton, and Stephen H. Spurr. 1997. Forest Ecology (4th Edition). John Wiley and Sons, Inc. New York, NY. p. 282. (See also Surface Fire)

Cumulative Effects
Individual actions when considered alone may not have a significant impact on the quality of the human environment. Groups of actions, when added together may have collective or cumulative impacts that are significant. Cumulative effects that occur must be considered and analyzed without regard to land ownership boundaries. Consideration must be given to the incremental effects of past, present, and reasonably foreseeable related future actions of the Forest Service, as well as those of other agencies and individuals. Source: CEQ Regulations applied to US Forest Service regulations http://www.fs.fed.us/emc/nepa/includes/epp.htm#c151

Defensible Space
This is an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure. It also reduces the chance of a structure fire moving from the building to the surrounding forest. Defensible space provides room for the firefighters to do their jobs.(New Mexico State Forestry) Many communities are taking a more holistic approach of creating defensible neighborhoods rather than just individual properties.

Ecosystem
A spatially explicit, relatively homogeneous unit of the earth that includes all interacting organisms and components of any part of the natural environment within its boundaries. An ecosystem can be of any size-a log, pond, field, forest, range or grassland, or even the earth' s biosphere. (Society of American Foresters, 1998.)

Ecosystem Function
The process through which the constituent living and nonliving elements of ecosystems change and interact, including biogeochemical processes and succession.

Ecosystem/Ecological Integrity
The completeness of an ecosystem that at multiple geographic and temporal scales maintains its characteristic diversity of biological and physical components, spatial patterns, structure, and functional processes within its approximate range of historic variability. These processes include: disturbance regimes, nutrient cycling, hydrologic functions, vegetation succession, and species adaptation and evolution. Ecosystems with integrity are resilient and sustainable.

Ecosystem Process
The actions or events that link organisms and their environment, such as predation, mutualism, successional development, nutrient cycling, carbon sequestration, primary productivity, and decay. Natural disturbance processes often occur with some periodicity (From Webster's dictionary, adapted to ecology).

Ecosystem Resilience
The ability of a system to respond to disturbances. Resiliency is one of the properties that enable the system to persist in many different states or successional stages.

Fire Frequency (Fire Return Interval)
How often fire burns a given area; often expressed in terms of fire return intervals (e.g., fire returns to a site every 5-15 years). (see also Fire Regime Group).

Fire Regime Group
A generalized description of the role fire plays in an ecosystem. It is characterized by fire frequency, predictability, seasonality, intensity, duration, and scale (patch size), as well as regularity or variability. (See also Fire Frequency)

Forest Ecosystem Health
A condition where the parts and functions of an ecosystem are sustained over time and where the system's capacity for self-repair is maintained, allowing goals for uses, values, and services of the ecosystem to be met.

Forest Ecosystem Restoration
Holistic actions taken to modify an ecosystem to achieve desired, healthy, and functioning conditions and processes. Generally refers to the process of enabling the system to resume acting, or continue to act, following the effects of a disturbance. Restoration management activities can be active (such as control of invasive species, thinning of over-dense tree stands, or redistributing roads) or more passive (more restrictive, hands-off management direction that is primarily conservation oriented). Frequently, a combination or number of actions is used sequentially to achieve restoration goals.

Hazardous Fuel
Excessive live or dead trees and other vegetation and organic debris that increase the potential for uncharacteristically intense wildland fire and decrease the capability to protect life, property, and natural resources.

Invasive or Noxious Weed (also applies to animals and other organisms)
Any species of plant which is, or is liable to be, detrimental or destructive and difficult to control or eradicate and shall include any species that the director, after investigation and hearing, shall determine to be a noxious weed. Arizona Revised Statutes 3-201 http://www.azleg.state.az.us/ars/3/00201.htm

Landscape
An area composed of interacting and inter-connected patterns of habitats (ecosystems) that are repeated because of the geology, landform, soils, climate, biota, and human influences throughout the area. Landscape structure is formed by patches (tree stands or sites), connections (corridors and linkages), and the matrix. Landscape function is based on disturbance events, successional development of landscape structure, and flows of energy and nutrients through the structure of the landscape. A landscape is composed of watersheds and smaller ecosystems. It is the building block of biotic provinces and regions.

Natural Disturbance Regime
A natural disturbance (e.g. fire, insect outbreak, flood) with a characteristic frequency, intensity, size, and type that has influence on an ecosystem over evolutionary time.

Old Growth Tree
This is an old tree, one that exhibits the complex structural attributes associated with the oldest age class of trees in an old growth stand. In today's forests, an old-growth tree is one that has been standing since before the onset of commercial logging and fire exclusion. These trees are sometimes referred to as pre-settlement trees. Old-growth ponderosa pine trees typically have orange, platy bark. Source: Schubert, G.H. 1974. Silviculture of southwestern ponderosa pine: the status of our knowledge. USDA Forest Service General Technical Report RM , http://www.ancienttrees.org/cfogga.php#1

Prescribed Fire
Any fire ignited by management actions to meet specific objectives. All prescribed fires are conducted in accordance with prescribed fire plans. (See also Wildland Fire Use)

Risk to Communities
The risk associated with adverse impacts to communities resulting from unwanted wildland fire.

Surface fire
A fire that burns over the forest floor, consuming litter, killing aboveground parts of herbaceous plants and shrubs, and typically scorching the bases and crowns of trees. Source: Barnes, Burton V., Donald R. Zak, Shirley R. Denton, and Stephen H. Spurr. 1997. Forest Ecology (4th Edition). John Wiley and Sons, Inc. New York, NY p. 281 (See also Crown Fire)

Sustainable (Sustainability)
Meeting the needs of the current generation without compromising the ability of future generations to meet their needs. Ecological sustainability entails maintaining the composition, structure and processes of a system, as well as species diversity and ecological productivity. The core element of sustainability is that it is future-oriented. (Committee of Scientists Report, 1999.)

Wildland Fire Use
The management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in pre-defined geographic areas outlined in Fire Management Plans. (See also Prescribed Fire)

Wildland-Urban Interface
The area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel.

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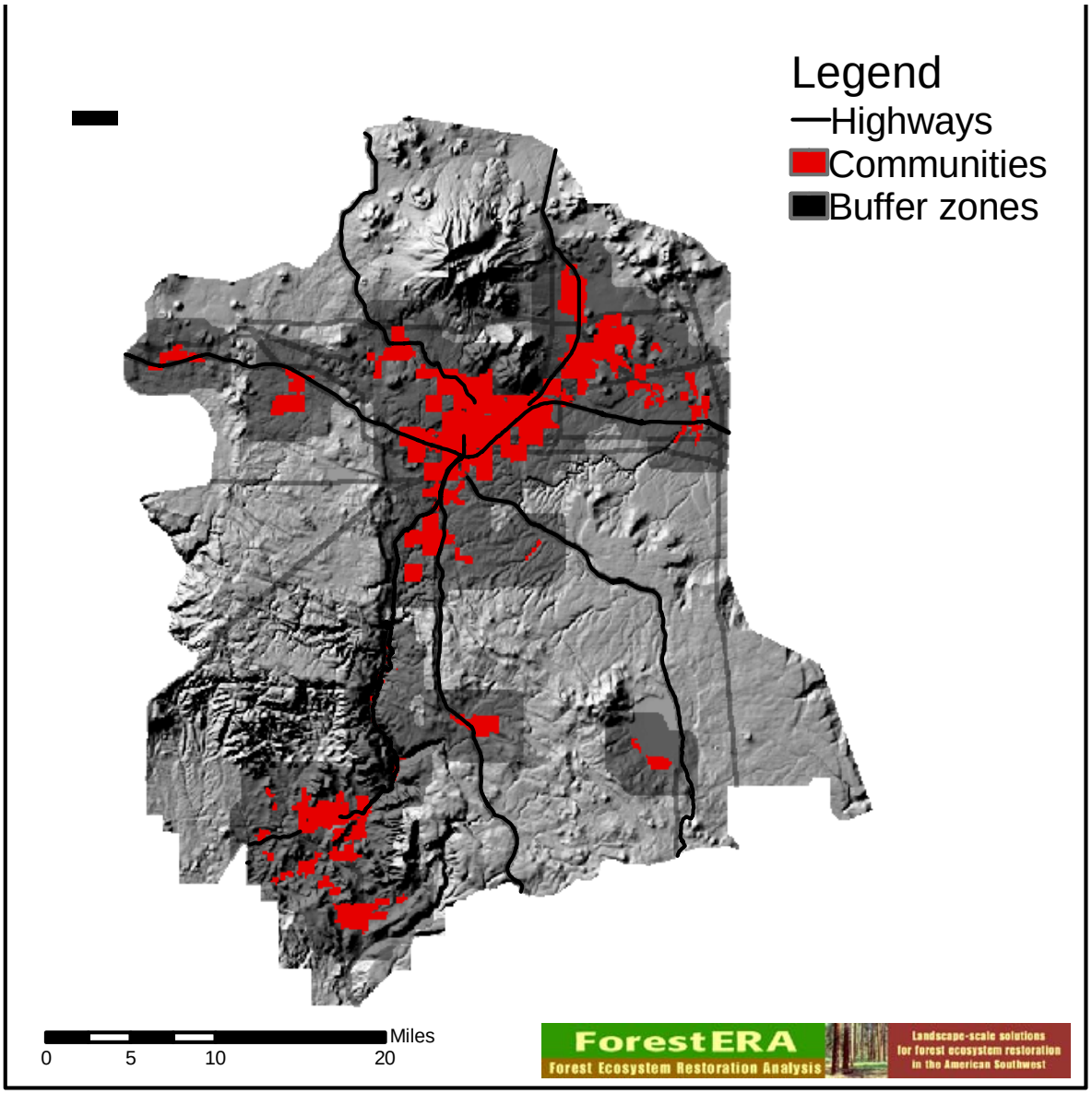
Appendix 3

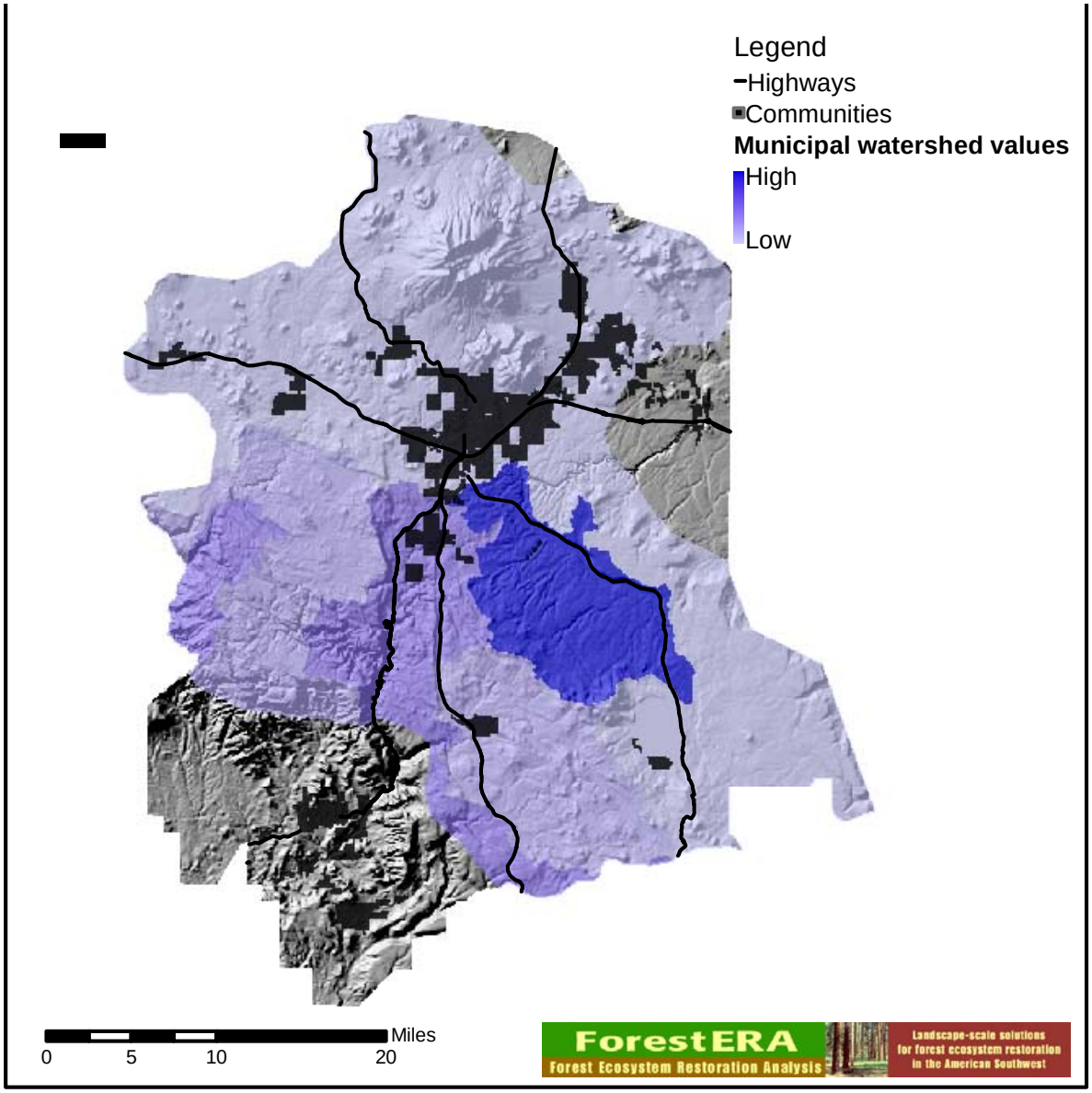
Attributes Utilized in Development of the Threat Map

COMMUNITY BUFFER

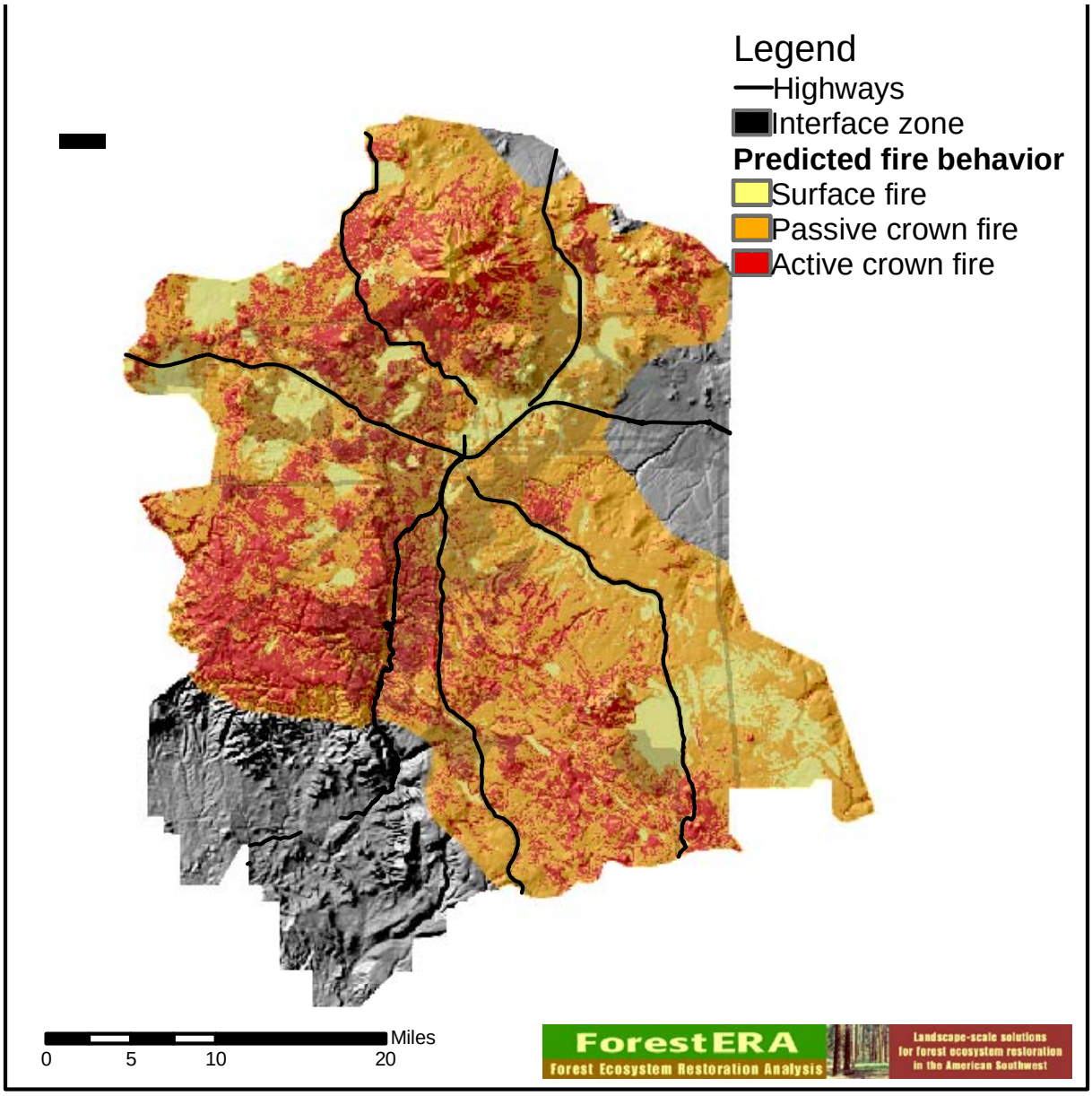


1½ miles Around At-Risk Communities

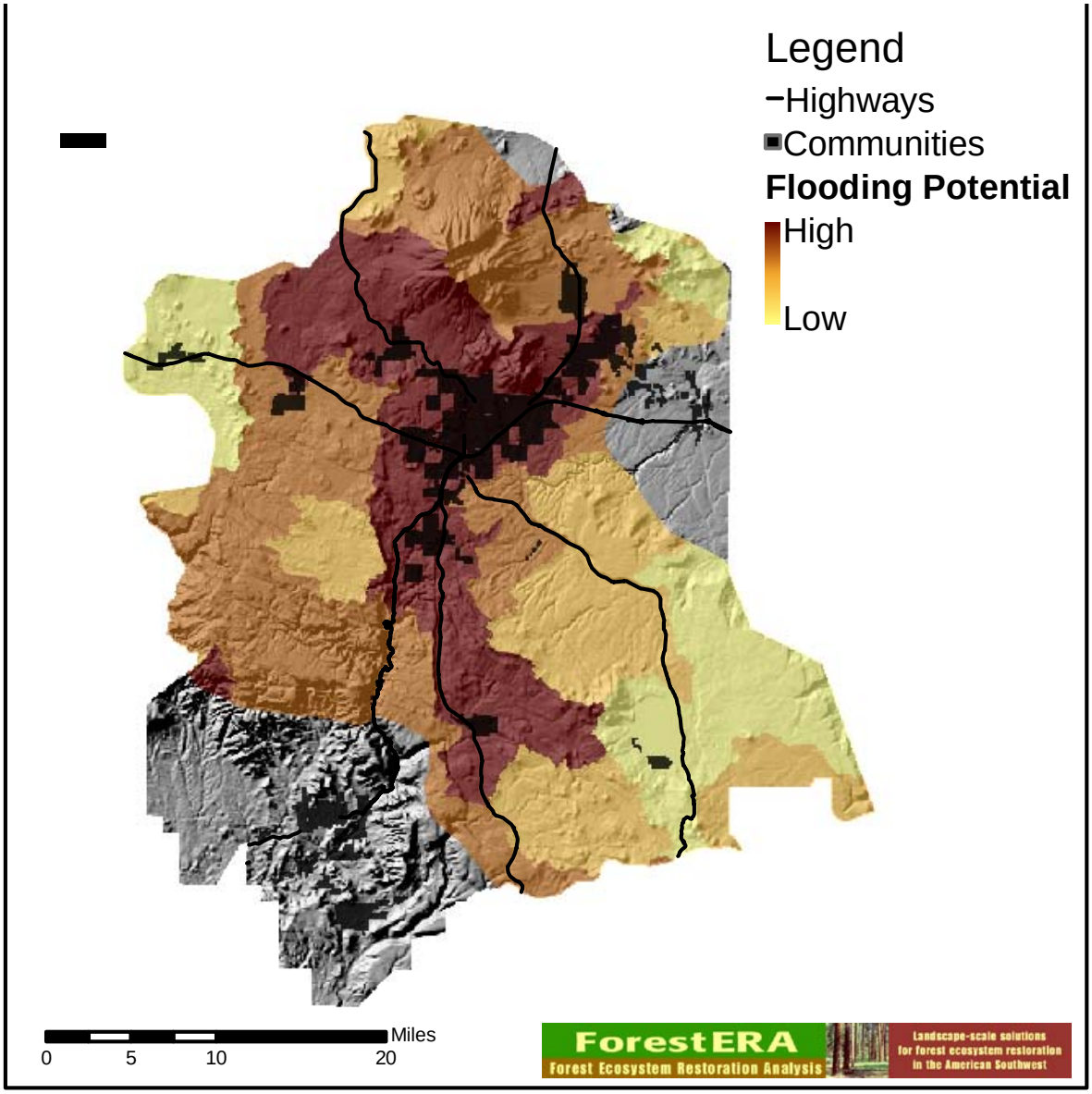
MUNICIPAL WATERSHED



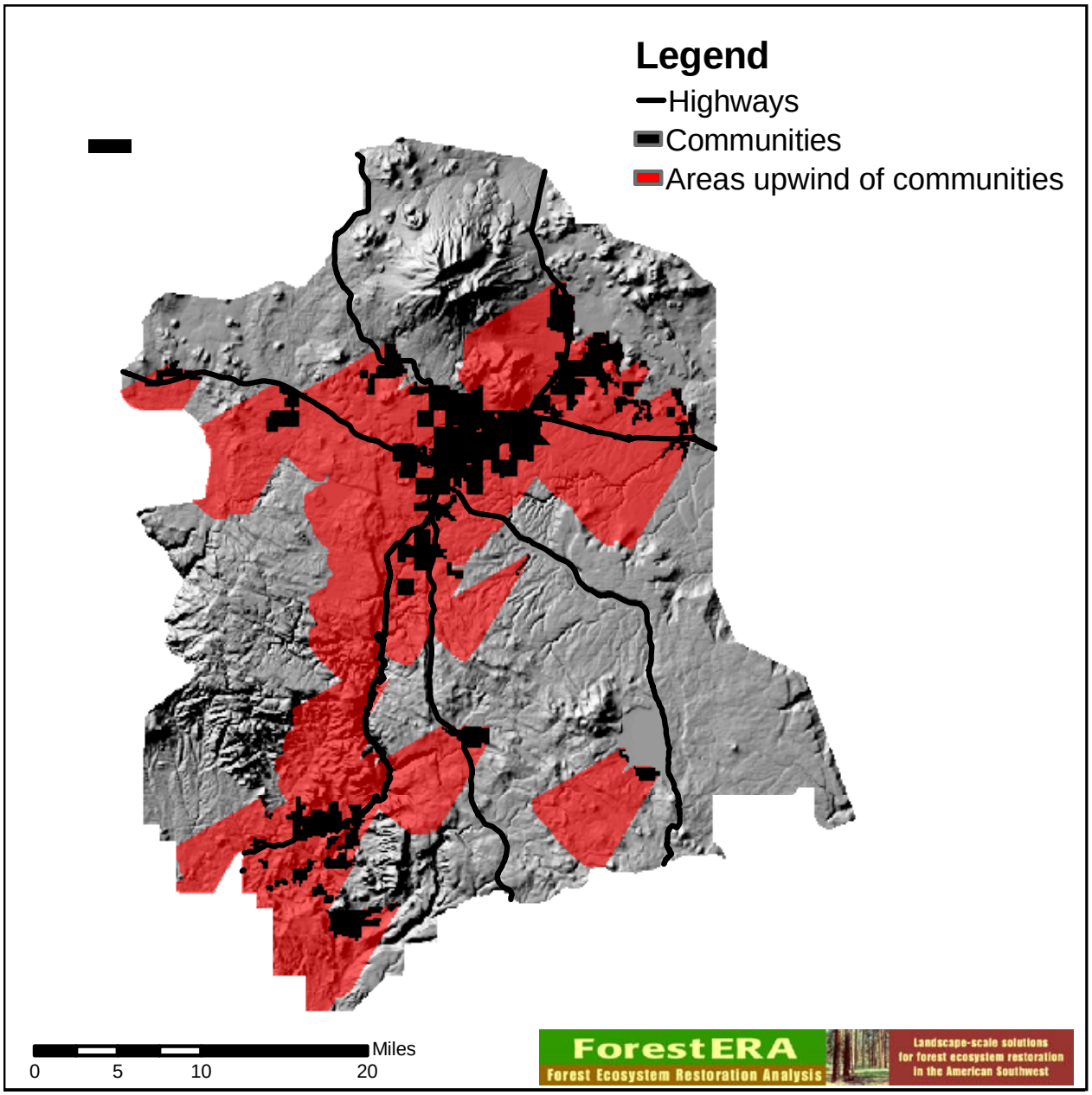
PREDICTED FIRE BEHAVIOR



FLOODING POTENTIAL



AREAS UPWIND FROM AT-RISK COMMUNITIES



Six-mile Buffer

Appendix 4

PFAC Operating Plan

A Partnership of Emergency Services
In the Greater Flagstaff Area

Initial and Extended Attack Wildland Fire Operations Plan for the PFAC Response Area

***** MODIFIED *****

May 1, 2004

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III. Emergency Scene Operational Responsibilities
1) Aviation Operations in the Urban Interface / Congested Areas
2) Temporary Flight Restrictions
IV. When Initial Attack Fire becomes an Extended Attack Fire
V. Joint Information Center
VI. Law Enforcement
1) Evacuation
2) Traffic Control
3) Security

Purpose

The purpose of this document is to prepare an organized operations plan that will be in place in the event of any initial or extended attack fires within the PFAC response area. This area includes the cities of Flagstaff and Sedona as well as the following fire districts; Flagstaff Ranch, Highlands, Mormon Lake, Parks-Bellemont, Pinewood, Sedona and Summit Fire. This area also includes all of the State and Federal lands throughout this area. This plan is meant to deal with incidents that do not exceed the complexity level of a Type 3 incident. This plan builds on the current Mutual Aid Agreement amongst all PFAC members and will help to maximize effectiveness and efficiency in providing safe and professional responses to wildland fire incidents throughout our area.

Initial Incident Notification and Dispatch Procedures

In order to clearly understand our dispatch procedures, please understand the distinctions between the three primary dispatch centers we will be dealing with.

"Flagstaff"- This dispatch center is run by the Coconino National Forest and will be the primary dispatch center for all wildland incidents. While it is not always staffed 24 hours a day, there is an answering service that will begin the activation process if any call is made to the Fire Reporting number, 526-0600.

"Alarm" (Flagstaff/Coco Co. 911) - This dispatch center is run by the City of Flagstaff Police Department and also dispatches for the Coconino County Sheriff's Office. "Tones" will be given by this center to initiate a wildland fire dispatch to all northern fire departments, which will then transfer to Channel 10 and have all further communications with "Flagstaff".

"Alarm" (Sedona FD, Pinewood FD) - This dispatch center is run by the Sedona Fire Department. "Tones" will be given by this center to initiate a wildland fire dispatch to all southern fire departments, which will then transfer to the Flagstaff Coconino 1 Channel and have all further communications with "Flagstaff".

1) ***Call comes into an Alarm Center***
   Alarm locates jurisdictional responsibility and dispatches those resources. After agency notification, Alarm will immediately notify Flagstaff of the incident and which units are responding. Flagstaff will dispatch any additional or requested resources based upon the predetermined Dispatch Model for Fire Danger Levels.

2) ***Call comes into Flagstaff***
   Flagstaff will immediately determine jurisdictional responsibility and dispatch closest available state or federal resources based upon the Dispatch Model for Fire Danger Levels. Flagstaff will contact an Alarm Center if the closest available resources are not state or federal units and Alarm will initiate dispatch. Initial dispatching of resources will be based upon the predetermined Dispatch Model for Fire Danger Levels.

3) ***Call comes into Arizona State Land***
   In the case of Initial Attack fires, all dispatches for SLD will go through Flagstaff. Flagstaff will dispatch appropriate agencies as indicated in the Dispatch Model for Fire Danger Levels. The ASLD will provide to the responding agency or agencies the authority to make appropriate requests for resources until their arrival.

<u>All dispatch duties after the initial dispatch will be done by Flagstaff.</u>

Dispatch Model for Fire Danger Levels

(These are minimum dispatch levels and may be adjusted accordingly).

Flagstaff will dispatch resources based on fire danger levels. They are L=Low, M=Moderate, H=High, **VH=Very High, and E=Extreme**.

1) Single Jurisdiction Fire:

L-H The agency of jurisdiction will be dispatched to this incident. Adjacent jurisdiction(s) who feel their jurisdiction could be threatened may also respond.

VH- E Flagstaff will automatically dispatch an additional two (2) engines, water tender, and two (2) overhead above the normal dispatch of resources as available. A dozer will be dispatched as requested by the IC or at the discretion of Flagstaff.

2. Multi-jurisdictional Fire:

L-H Primary Jurisdiction/Closest Available Resources respond as appropriate. **(USFS & FD**) Adjacent jurisdiction(s) who feel their jurisdiction could be threatened may also respond.

VH-E Flagstaff will automatically dispatch an additional two (2) engines, water tender, and two (2) overhead above the normal dispatch of resources as available. A dozer will be dispatched as requested by the IC or at the discretion of Flagstaff.

The purpose of identifying a Dispatch Model for Fire Danger Levels, especially during Very High to Extreme conditions, is to keep small fires from getting large. We encourage fire agencies to monitor USFS Channel 1 and if a **'fire flash'** is in your jurisdiction to initiate a response. It is imperative that if a response is initiated in this manner or if a report comes directly into an agency, **contact with Flagstaff and Alarm should be done immediately.** If Flagstaff gets notification of an incident during Very High to Extreme conditions, **they will immediately dispatch closest available resources** as identified in the Fire Order Model for Dispatch.

Please note that all non-jurisdictional companies will be released as soon as possible to become available back in their home areas. Also, the response request can be denied by the requested agency if they can not meet the demands of the request.

Contact with both Flagstaff and Alarm will also be made when any agency is involved in an incident(s) that removes all of their resources from availability. If this notification is made, a time frame should be given for unavailability. When units become available, contact will be made to both Flagstaff and Alarm of their availability.

After the initial dispatch, all units will use Forest Service Channel 1 to communicate with all units responding to a wildland incident. Upon arrival at the incident, the use of a tactical channel(s) will be used as designated by the IC. The following channels will be identified as Group 2 for Initial Attack (IA) in those radios that are capable of multiple groups or are field programmable. **Please note**: The City of Flagstaff Fire Department does not have multiple group radios and use of our standard group one channels will be necessary. It is only at the request of the IC that the use of the pre-identified Group 2 frequencies will be used.

As this Operations Plan is a supplement to our existing PFAC Mutual Aid Agreement, all agencies agree to allow the use of their frequencies to other agencies while involved in the mitigation of an incident.

Emergency Scene Operational Responsibilities

Regardless of jurisdiction, first on scene unit will assume Incident Command. IC will communicate with Flagstaff the following:

a. Initial size-up to include size, IC, fire name, etc**. (use IRPG)**
b. Location/Jurisdiction
c. Additional resource requirements
d. Immediate concerns, exposures, access, etc.

At this time, command of the incident may be transferred to the appropriate jurisdictional personnel or may be transferred due to the level of complexity of the incident.

2) Aviation Operations in the Urban Interface / Congested Areas

All aircraft use will be ordered and coordinated through the Flagstaff Zone Dispatch Office in accordance with established procedures in the Southwest Area Mobilization Guide.

The following will apply to determine air-tanker use when dispatched to congested areas:

1. A Lead Plane will be ordered any time an air-tanker has been requested for use in a congested area. Air Tanker Drops may precede before the Lead Plane arrives if communications are established between the aircraft and Incident Commander, authorization is granted from the IC, and the line is cleared of personnel and equipment prior to commencing retardant operations.

2. Aerial supervision (Air Tactical Group Supervisor) is recommended when there are more that two aircraft or a mix of aircraft (fixed/rotor-wing) over the incident at the same time.
3. An Air Operations Branch Director will be ordered for any fire requiring continuous air-tanker or helicopter operations within the congested area to coordinate with the Flagstaff Airport Manager and/or Control Tower in the designing and implementation of Temporary Flight Restrictions and aviation operations. The AOBD may also assist in the establishment of dip-sites and heli-base operations.

3) Temporary Flight Restrictions

When fires occur, there may be a need to request Temporary Flight Restrictions to secure airspace over the incident for aviation operations. These restrictions will be requested by the Incident Commander, Air Tactical Group Supervisor, or the Air Operations Branch Director through the Flagstaff Zone Dispatch Center. The request will be made to the Southwest Coordination Center, who will advise when the TFR goes into effect. This may take 2-4 hours. When the restriction is no longer needed, it should be rescinded as soon as possible.

The TFR will need to be configured and closely coordinated with the Flagstaff Airport Manager and Control Tower as nearly every portion of our urban interface areas have the potential to impact airport operations. A guide for Incident Commanders in determining the need for a TFR includes:

- Type and number of aircraft operating (Air Tactical, air-tanker, helicopter) within the incident and their aeronautical requirements including orbit dimensions horizontally and vertically.
- Entry and exit points and routes for incident aircraft.
- Multiple incidents in close proximity.
- When the extent and complexity of the operation creates a hazard to non-participating aircraft.
- Incident is expected to attract sight-seeing aircraft.
- Operations are being conducted near or in the dimensions of a military training areas
- Incident is being conducted in or near a Victor flyway.
- "See and Avoid" capabilities are reduced or compromised.

When Initial Attack Fire becomes Extended Attack

When it is determined by the IC that this Initial Attack Fire has become an Extended Attack Fire, a request will be made by the IC for an activation of the Flagstaff Zone Type 3 team, or a Type 1 or Type 2 IMT based upon the Coconino National Forest's Complexity Analysis.

When the Type 3 Team is called for, Flagstaff will begin the notification process for the Type 3 Team. The County Emergency Services Coordinator and/or City Manager will be notified immediately by Flagstaff through the appropriate Alarm Center. It will be the County Emergency Coordinator or City Manager's decision to activate the EOC.

Joint Information Center

If an EOC is established a Joint Information Center will also be established at the EOC. If an EOC is not established, the Joint Information Center will be located at the Peaks Ranger District, the Flagstaff Law Enforcement Administrative Facility (LEAF) or Sedona Fire Station #1.

Law Enforcement

Law enforcement is recognized as a needed and essential part of any IA fire of any consequence. The appropriate LE agency having jurisdiction in the area of a fire will be notified immediately. The Law Enforcement Representative will meet with either the Liaison Officer or IC. As needed, a Law Enforcement Branch will be established.
Responsibilities for Law Enforcement will be determined by their representative and the Incident Commander.

1) ***Evacuation***
   Upon determination by the Incident Commander and/or the Sheriff that evacuation procedures are warranted, the Coconino County Sheriff's Office, the City of Flagstaff Police Department, the Sedona Police Department, the Arizona Department of Public Safety, the Arizona Department of Transportation, or any other appropriate law enforcement agencies shall be responsible for implementing an appropriate evacuation. The Law Enforcement Liaison shall report evacuation progress to the Incident Commander, on a regular basis. CCEM must be notified early in this process, to provide appropriate reception areas/shelters.

2) ***Traffic Control***
   The Coconino County Sheriff's Office, City of Flagstaff Police Department, and other law enforcement agencies shall be responsible for implementing a traffic control plan. Continued communication with the Liaison or the IC is essential.

   It is important that a law enforcement liaison be established early in the incident (at the Command Post) in order to minimize traffic congestion and maintain safety to the public.

3) Security

It shall be the responsibility of the jurisdictional law enforcement agency to establish, when appropriate, a security patrol for evacuated areas yet to be immediately threatened by fire (pre-cautionary evacuation mode), in conjunction with the law enforcement coordinator assigned to the command staff. The appropriate LE agency will assist in securing the perimeter of the incident to allow authorized persons only into and out of the area.

Appendix 5

PFAC Smoke Management Plan

A Partnership of Emergency Services
In the Greater Flagstaff Area

Community Smoke Management Plan for the PFAC Response Area

***** MODIFIED *****

May 12, 2004

Purpose: Catastrophic wildfire is the #1 threat to the greater Flagstaff area. A wide range of community values – documented elsewhere – are impacted by these type wildfires. Reducing overabundant natural fuel accumulations and improving forest health within and adjacent to communities must occur.

One method to do so is the application of prescribed (Rx) fire. Rx fires reduce slash accumulations produced during fuel reduction projects, as well as forest surface fuels that have accumulated during the past decades. Restoring fire to the ecosystem improves forest health increases community protection capability.

Background: Smoke is a natural result of fire: the issue we must focus on is not if we should have smoke - we have no choice: it will either be wildfire or prescribed – but when, where, and under what conditions it will occur. The only way we can focus on, and manage, these issues, is with application of Rx fire and implementation of a Community Smoke Management Plan (CSMP).

Components: The three primary components of this plan are:

Emission Reduction Techniques: These include, but are no means limited to –

- Removing wood products (firewood, post-and-pole, etc)
- Allowing sufficient time for material to dry
- Avoiding stumps, downed logs, snags
- Restricting piles or acreage
- Limiting consecutive burn days in same area
- Utilizing proper ignition patterns
- Timing ignitions to coincide with favorable weather events
- Scheduling to avoid special event days or high-occupancy sites

Public Awareness: Three separate areas require continuing attention -

1) On-Going: Brochures, website information, special presentations, and media interviews are valuable techniques to establish the purpose of Rx fire, methodology of planning, ERT's and control efforts, future plans, agency coordination practices, and results of previous burns. Together, these will serve to reduce concerns associated with Rx fire.

2) Pre-Fire: These announcements must inform the public of project locations, dates and times of implementation, and homeowner mitigation measures they can implement to reduce impacts to their own health, property, and daily activities. They can be distributed through the media, posting specific project information on agency websites; notifying homes and neighborhoods immediately adjacent to burns as well as areas which will be significantly impacted (both day and night), and personal contacts to individuals with high health concerns. Fire managers must provide a common message including project goals and smoke mitigation efforts.

3) During Burn: Techniques during an on-going Rx fire could include empowering each person on-site to act as an Information Officer if approached by the public, placement of a designated person at a site easily accessible to the public and within site of the burn to answer questions, or leading field tours for interested people. If unexpected conditions occur during the operation, efforts to minimize impacts should be announced, what is being done to mitigate the impacts, and responsibility stated to ensure continued public acceptance of the program.

Agency Coordination: A culture of open-and-continuing communication and coordination between land management agencies, fire management professionals, public health organizations, and air quality regulators is critical for an efficient and effective Rx fire program. Project planning, treatment priorities, coordination with adjacent Rx fires, resource sharing, public notification, and potential smoke impacts and mitigation efforts require discussion and joint involvement.

Monitoring day and night smoke movements through personal observations, mapping, and photographs will enable local fire managers to document and share information on smoke-travel patterns, effectiveness of smoke mitigation efforts, and potential accuracy of forecasted weather information. Instrument-based air-quality monitoring, the responsibility of regulatory agencies, can help determine visual and health impacts, compliance with air quality standards, and provide information necessary to refine future Rx fire efforts. In addition, post-Rx fire reviews are beneficial so lessons can be identified and shared with others.

Permits: Local Fire Depts and Fire Districts are allowed, through an agreement with the AZ Dept of Environmental Quality (ADEQ), to issue permits for small debris burns within their jurisdiction. State and Federal agencies, and larger burns within the Fire Dept/Fire District jurisdictions, require a permit from ADEQ. Permit information is available at:
www.adeq.state.az.us/environ/air/assess/smp.html

Public Notification Contacts:

1) Contact information for PFAC agency personnel can be found in PFAC Operating Plan (Appendix 1 to the CWPP)

2) Each agency will maintain their own individual homeowner/business contact list

Result: Effectiveness of the CSMP will be determined by level of public awareness, including acceptance of reasonable smoke, the success of agency coordination, and the continued-and-timely application of ERT's. Efforts to further the Rx fire program will pay dividends in the future: the wise use of Rx fire will reduce fire threat, improve forest health, and protect our community.

Appendix 6

Utilization: GFFP UET Accomplishments & Work Plan

STATUS REPORT

Small Diameter Timber Utilization ***July 15, 2004***

GREATER FLAGSTAFF FORESTS PARTNERSHIP ECONOMIC VISION

GREATER FLAGSTAFF FORESTS PARTNERSHIP
WWW.GFFP.ORG

Twenty years from now, the greater Flagstaff area will be home to a small but thriving sector of businesses based on the ecologically sustainable utilization of forest products. Revenues created through the sale of these forest products will provide the economic engine for ecosystem restoration efforts in the region's forests.

Businesses will include primary producers of forest products and "value-added" processors employing technologies that maximize the value of forest products. Availability of these forest products will be based on long-term forest management planning, and healthy ecosystem functioning, seeking a sustainable and stable flow of products to users, which in turn will provide stable jobs and benefits for local workers and the community.

PARTNERSHIP ENDORSED PROJECTS

The Arboretum at Flagstaff: The Arboretum applied for and received $50,000 from the *Southwest Sustainable Forests Partnership* for the purchase and installation of a wood pellet boiler system for district heating. Preliminary engineering studies have been completed by *Forest Energy, Corp.*, and marketing and interpretation plans are being developed.

Arizona Corporation Commission: Consultation with the Corporation Commission regarding the inclusion of woody biomass as an energy option in the revision of the Environmental Portfolio Standard.

Arizona Governor's Office: Consultation with the Governor's staff and the *Greater Flagstaff Economic Council* on a pending executive order requiring consideration of wood/pellet heating in state facilities.

Arizona Public Service: Three locations have been identified in the Flagstaff area for the siting of biomass energy power plants. Preliminary feasibility and air quality studies have been completed by APS. Projects are on hold pending financing and final approval.

Indigenous Community Ventures (ICV): ICV is the recipient of $95,000 from the Partnership to purchase an LT300 Wood-Mizer to expand business operations to log home construction. ICV is currently producing log hogans in partnership with Indigenous Community Enterprises and has hired marketing consultants to expand production to off-reservation log homes.

Northern Arizona University: University officials are exploring the installation of a district wood pellet heating system for the central campus in conjunction with *Forest Energy, Corp*. Meetings and negotiations are on-going with project partners to initiate a feasibility study.

Savannah Pacific Corp., LLC: Company officials are proposing the location of a glulam plant and small diameter sawmill facility in the Flagstaff area capable of processing 25 million board feet annually. Preliminary site assessment has been completed and a conditional use permit has been approved for the glulam operation. Project is currently on hold pending financing for the Flagstaff area operation.

Total Timber: Total Timber is the recipient of $100,000 from the Partnership to purchase equipment and initiate business operations for a commercial firewood processing plant in Flagstaff. The business is currently in production and meeting targeted first year sales.

PROJECT MONITORING

Arizona Lumber Industries, Inc.: Proposed location of an oriented strand board (OSB) facility in the greater Flagstaff area capable of processing small diameter ponderosa pine. Project is currently in the due diligence phase.

City of Tusayan: The city has hired a bioenergy consultant to assess the feasibility of a fluidized bed (gasification system) for converting woody biomass and municipal solid wastes to energy.

Forest Energy, Corp., LLC: Proposed location of a wood pellet processing facility in the Flagstaff area to manufacture densified fuels for commercial heating systems. Project is in the due diligence phase.

Mogollon Brewery, Co.: Proposed location of biomass ethanol facility in Flagstaff. Project is currently in the scoping phase to assess feasibility of ethanol production.

National Relief Charities: The non-profit organization is developing partnerships among the *Hopi Nation*, *High Desert Investments*, and the *Coconino National Forest* to provide approximately 400 cords of donated firewood to tribal members over 65 years of age.

BIOgen Power Group, LLC: Proposed location of 10MW biomass energy plant in Prescott
Dakota Hauling and Timber, Inc.: Sawlog processing in Humboldt within the Prescott basin
Fred Merritt Sawmill: Sawlog processing in Ash Fork
LB International, Inc.: Heating and camping log production at *Eco-Lena, LLC* in Winslow
Perkins Sawmill, Co.: Sawlog and firewood processing in Williams
Twin Mountain Ranch: Pallet Division: Wood pallet operations in Williams
Zellner's Firewood: Mobile firewood operations in Williams

PARTNERSHIP MARKETING & REPORTS

- Small Diameter Timber Utilization & Marketing Brochure (2004)
- In-Woods MicroMill Economic Assessment (2004)
- Coordinated Resource Offering Protocol – CROP (2003)
- Enterprise Development Fund for Small Wood Utilization in the Greater Flagstaff Region (2003)
- Preliminary Feasibility Assessment for a Biomass Power Plant in Northern Arizona (2002)
- Small Log Sawmill Site Assessment Study for Northern Arizona (2002)
- Small Diameter Sawmill and Small Log Processing Mill Run (2002)
- Small Diameter Wood Utilization Strategy (2002)
- Lumber Recovery From Small Diameter Ponderosa Pine From Flagstaff, Arizona (2001)
- Log Sort Yard Model and Commentary (2001)
- Does a Log Sort Yard Make Sense for Forest Restoration? (2000)
- Market & Utilization Options for Low-Value Wood Products: Preliminary Assessment of Markets (1999)
- Southwest U.S. Regional Wood Products Industry Survey: Summary of Findings (1999)
- Northern Arizona Post and Pole Enterprise Feasibility Assessment (1999)
- Feasibility Assessment for Development of a Log Merchandising & Manufacturing Center in N. AZ (1999)
- Feasibility of Producing Commercial Products From Pinon-Juniper Woodlands (1997)
- Potential for Using Small Diameter Ponderosa Pine Resources in Arizona: A Feasibility Study (1997)

PARTNERS IN UTILIZATION

- Greater Flagstaff Economic Council
- Small Business Development Center
- Coconino County
- City of Flagstaff
- Coconino National Forest, USFS
- Rocky Mountain Research Station, USFS
- Pacific Northwest Research Station, USFS
- Forest Products Laboratory, USFS
- Arizona Sustainable Forests Partnership
- Southwest Sustainable Forests Partnership
- Four Corners Sustainable Forests Partnership
- Northern Arizona Forest Products Association
- AZ Dept. of Commerce, Industries of the Future
- Arizona Governor's Office

Utilization and Economics Annual Work Plan

Guiding Principles

- Providing information and resources to existing and prospective small businesses.
- Getting small companies to relocate or expand to Flagstaff.
- Keeping the momentum going with the Utilization & Economics Team.
- Seeking expanded utilization of Pinyon-Juniper in addition to Ponderosa Pine.
- Seeking economically feasible ways to do forest thinnings.
- Seeking funding to conduct research and product development.
- Identifying and expanding markets for small diameter material.
- Finding suitable markets to reduce the costs of service contracts.
- Strengthening partnerships in light of rapidly changing regulatory situations.
- Matching of utilization options to community needs and capacities.
- Regional coordination of partners.
- Positioning partnership for national priorities in regard to utilization.

2004 UET Projects & Strategies (Proposed)

1) Continue efforts focused on biomass and expand focus on district heating systems

- Continuing to work with the AZ Corporation Commission on the Environmental Portfolio Standard (EPS) – write letters of support, seek expansion of EPS to include biomass from forest thinnings, seek expansion of EPS beyond 2012 deadline.
- Seek thermal credits for using wood heating.
- Conduct a feasibility or demonstration study on a wood-heating district leading to private and commercial investment.
- Continued identification of viable biomass technologies.
- Encourage local wood pellet consumption and market expansions – pursue wood pellet manufacturing in or near Flagstaff.

2) Continue efforts focused on forest supply issues

- Expansion of the CROP pilot project to include more suppliers, levelization of supply, and out-year planning and coordination among suppliers. Seek a 5-year funded project to coordinate local supply based on projected sustainability (GFFP-led).
- Encourage Forest Service to use stewardship authorities for levelized supply.

3) Formalize relationships between key UET partners and establish protocols for the sharing of information – Staff & UET partners

- Formalize relationships among key UET partners (GFFP, GFEC, SBDC, County, etc.).
- Establish protocols for sharing information sharing with similar/ related organizations.
- Provide a clearinghouse of UET-related information in coordination with the SBDC.
- Project development and management – point of contact to assist business development.
- Display and promote past accomplishments – the list of pubs in the PowerPoint posted on the web and able to download.
- Small business outreach and coordinate with Southwest Strategy (SWSFP, Region 3)

4) Increase and expand efforts to develop grant opportunities and other means of financial support for existing and prospective businesses

- Secure funding for continuation of the Enterprise Development Fund (EDF)
- Work closely with the GFEC and SBDC to identify and provide financial support to existing and prospective businesses.
- Establishing a revolving loan fund, perhaps with the sale of GFFP purchased stumpage.
- Host workshop(s) to assist landowners, contractors, and small businesses to better use grant opportunities (NRCS, ASLD, SBDC, etc.). Provide technical assistance to aid them in finding and applying for financial assistance.

5) Provide market assistance to existing businesses (UET partners)

- Provide technical assistance and counseling to businesses in identifying markets, developing marketing strategies, and understanding market drivers.
- Provide assistance to small businesses to develop effective business plans (SBDC).
- Create a database of raw material users and producers for the greater Flagstaff region.
- Develop marketing materials for prospective businesses to include existing studies, ongoing research, and other pertinent information and resources.
- Improve capacity of private sector small businesses by providing technical support.

6) Seek GFFP staff support for UET functions

- Hire a utilization and marketing staff person to carry out UET priorities.
- Out-source for project implementation.
- Share tasks with SWSFP on intern basis and overlap with other partner functions.
- Separate UET priorities from the work individual partners are doing. Share and elaborate that information. Identify GFFP capabilities to do remaining work.

7) Develop political strategies for all of the above priorities

- Track funding priorities of the Healthy Forest Act.
- Focus on locating sources of funding.
- Advocate in state, local, and federal government for support for forest restoration, development and program funding.

<u>Long-Range UET Projects & Strategies (Proposed)</u>

8) Education of small diameter timber utilization terms and practices

- Educate public and the GFFP partnership on local issues including technological advances in harvesting and feasibility of small diameter timber uses.
- Public awareness is high but there is deep mistrust of the wood products industry and the Forest Service relationship with private industry.
- Educate public on the ecological aspects of small diameter timber, its sustainability, and linkages to economic practices, community health, and related environmental impacts.
- Educate the public on the need to manage forests, wood products and the wood product industry as a cohesive unit with sustainability emphasized.

9) **Experiment with the GFFP purchasing stumpage from Coconino NF to sell to others.**

10) **Serve as a catalyst for a sustained yield-type unit**

11) **Continuation of Savannah-Pacific type mills – focus on economies of scale and ramping up volume processed**

12) **Develop strategies for linking healthy forests to healthy communities with appropriately scaled industries providing living wages and ecologically driven forest based products.**
- Continue community involvement in decisions regarding matching scale of restoration efforts and value-added, technically suitable utilization options with community needs.
- Can we play a role in creating the framework for ecologically and economically sustained use of our forest? We need to replace the boom-bust cycle of extractive industries.

13) **Invasive species and erosion from harvesting and wildfires**

14) **Portable, in-woods processing feasibility to reduce processing costs**

15) **Monitoring of community benefits from restoration projects and utilization**
- Social and economic impacts
- Ecological impacts of project implementation

16) **Explore green certification for local processors and National Forest lands**

17) **Create strategies to work with private landowners**
- Establish protocol to work with private landowners with less than 40 acres

18) **Seek long-term strategy to add value to small diameter timber linked to stumpage**

Appendix 7

Coconino National Forest Prevention Management Plan

Only a few pages of the plan are included here. For details on compartment assessment rankings, which may change on a regular basis, please consult the USFS/Coconino NF web page:

www.fs.fed.us/r3/coconino

Coconino National Forest
Prevention Management Plan

February 11, 2004

<u>** ABBREVIATED **</u>

Contents

Introduction & Management Objectives

Fire Prevention Compartment Listing

Compartment Detail
Compartment Assessment Rankings
- Fuels Hazard
- Protection Capability
- Ignition Risk
- Fire History
- Values
- Catastrophic Fire Potential
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Prevention Responsibilities

Prevention Work
- Prevention Specific and General Actions

Introduction

This Plan has been prepared for the Coconino National Forest using the Risk Assessment and Mitigation Strategies (RAMS) planning process. RAMS was developed for fire managers to be a holistic approach to analyzing wildland FUELS, HAZARD, RISK, VALUE, and SUPPRESSION CAPABILITY. It considers the effects of fire on unit ecosystems by taking a coordinated approach to planning at a landscape level, and allows users to develop fire prevention and/or fuels treatments programs.

The steps involved in this process included:

- Listing Management Objectives for the Coconino National Forest
- Identification of spatial Compartments for study
- Assessment of significant issues within each Compartment
- Identification of Management Objectives within each Compartment
- Identification of Fire Management Zones (FMZs) and Sub-Units
- Development of Alternative Fire Prevention Program Options
- Creation of Personnel and other Expense Prevention Budgets
- Identification of detailed Prevention Work Programs
- Development of a total Fire Prevention Program and budget

Management Objectives

The following Management Objectives are identified for the Coconino National Forest:

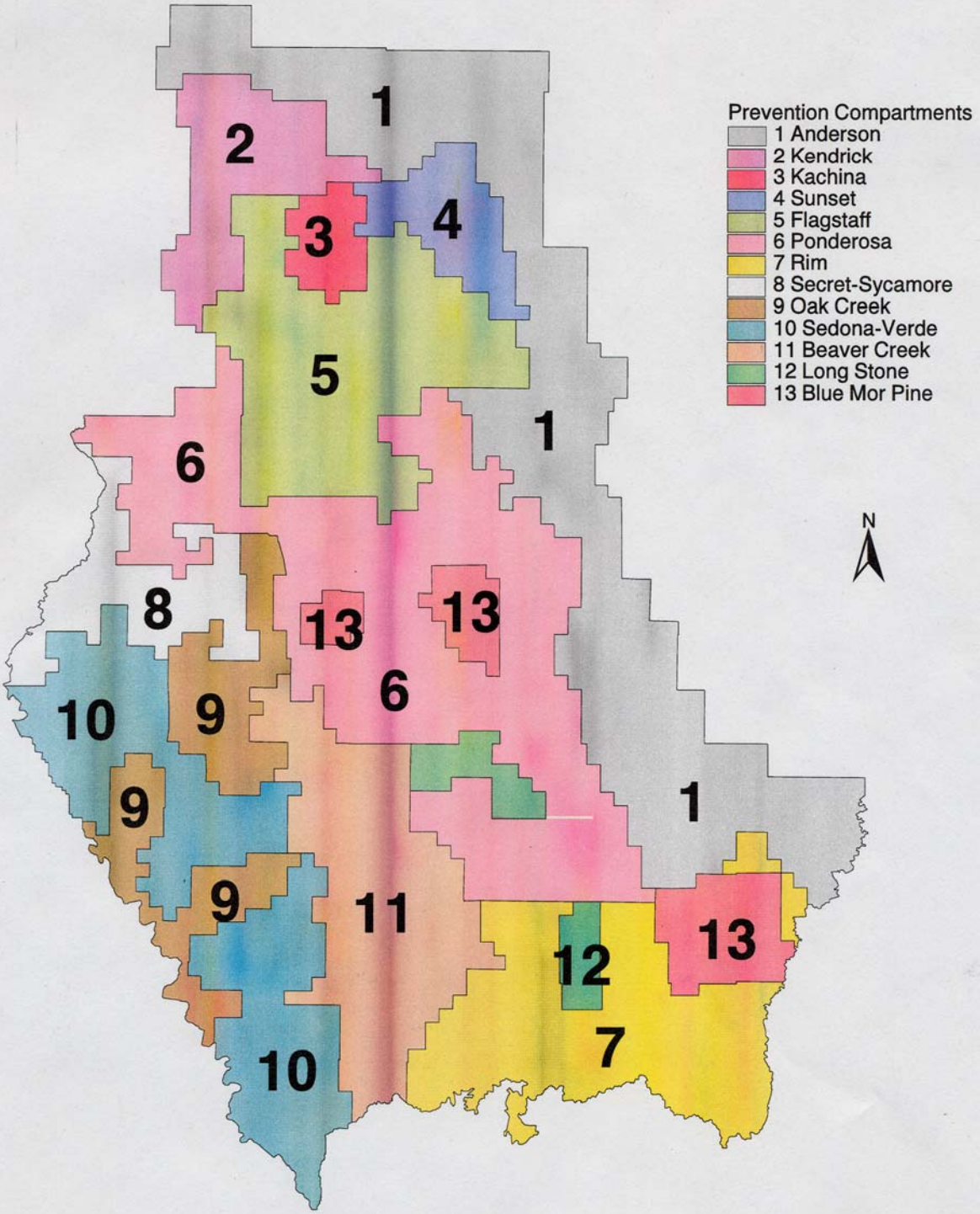
1. Maximize firefighter and public safety
2. To reduce resource loss due to human caused fires.
3. Cooperate with agencies in a combined wildfire and public fire education effort
4. Implement Fire Prevention Plan in a cost-effective manner

Fire Prevention Compartment Listing

Code	Description		
1	Anderson	8	Secret - Sycamore
2	Kendrick	9	Oak Creek
3	Kachina	10	Sedona – Verde
4	Sunset	11	Beaver Creek
5	Flagstaff	12	Long - Stone
6	Ponderosa	13	Blue - Mor - Pine
7	Rim		

Coconino National Forest

Fire Prevention Compartments



fdt 02/04

~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ *EXAMPLE OF A COMPARTMENT LISTING* ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~

Compartment 5: Flagstaff - Catastrophic Fire: Likely

Fuels Hazard characteristics are rated:

Fuels (flame length produced): **High**
Crowning Potential: **Moderate**
Slope Percent: **Moderate**
Aspect: **High**
Elevation: **Moderate**

Protection Capability ratings are:

Initial Attack: 0 - 20 minutes **(Low)**
Suppression Complexity: Complex **(High)**

Ignition Risk factors include:

Population Density - Wildland Urban Interface
Power Lines & Sub-station
Maintenance/service contracts
Active timber sale
Construction project
Debris/slash burning
Off highway vehicle use
Developed camping areas & Dispersed camping areas
Gas pumps or storage
Gas or oil wells/transmission
Electronic installations
Incendiary
Government operations
Woodcutting area, power equipment
Dump
Fireworks, children with matches
Cultural Activities
Shooting/target
Railroads
Public Access Road(s)
County road(s)
State/Federal highway(s)

Compartment Assessment Ranking
Fuels Hazard

Rating	Compartment		
High	8: Secret – Sycamore	Low	2: Kendrick
High	9: Oak Creek	Low	11: Beaver Creek
		Low	1: Anderson
Mod	13: Blue - Mor – Pine	Low	4: Sunset
Mod	12: Long – Stone		
Mod	6: Ponderosa		
Mod	5: Flagstaff		
Mod	10: Sedona - Verde		
Mod	3: Kachina		
Mod	7: Rim		

Compartment Assessment Ranking
Protection Capability

Rating	Compartment		
High	8: Secret – Sycamore	Low	9: Oak Creek
High	7: Rim	Low	5: Flagstaff
High	3: Kachina	Low	12: Long - Stone
High	13: Blue - Mor - Pine		
High	1: Anderson		
Mod	10: Sedona - Verde		
Mod	6: Ponderosa		
Mod	2: Kendrick		
Mod	11: Beaver Creek		
Mod	4: Sunset		

Compartment Assessment Ranking
Ignition Risk

Rating	Compartment		
High	5: Flagstaff	Low	1: Anderson
High	6: Ponderosa	Low	2: Kendrick
High	10: Sedona – Verde	Low	3: Kachina
High	13: Blue - Mor – Pine	Low	8: Secret – Sycamore
High	9: Oak Creek		
Mod	12: Long - Stone		
Mod	11: Beaver Creek		
Mod	4: Sunset		
Mod	7: Rim		

Compartment Assessment Ranking
Fire History

Rating	Compartment				
High	5: Flagstaff			Low	2: Kendrick
High	4: Sunset			Low	1: Anderson
High	6: Ponderosa			Low	11: Beaver Creek
High	7: Rim			Low	8: Secret - Sycamore
High	9: Oak Creek				
Mod	13: Blue - Mor – Pine				
Mod	10: Sedona - Verde				
Mod	12: Long – Stone	Mod	3: Kachina		

Compartment Assessment Ranking
Values

Rating	Compartment		
High	5: Flagstaff	Low	12: Long - Stone
High	10: Sedona – Verde	Low	4: Sunset
High	9: Oak Creek	Low	2: Kendrick
High	7: Rim	Low	1: Anderson
High	6: Ponderosa		
Mod	8: Secret - Sycamore		
Mod	13: Blue - Mor - Pine		
Mod	11: Beaver Creek		
Mod	3: Kachina		

Compartment Assessment Ranking
Catastrophic Fire Potential

Rating	Compartment		
High	13: Blue - Mor – Pine	Low	2: Kendrick
High	12: Long – Stone	Low	1: Anderson
High	9: Oak Creek		
High	7: Rim		
High	6: Ponderosa		
High	5: Flagstaff		
Mod	11: Beaver Creek		
Mod	10: Sedona - Verde		
Mod	8: Secret - Sycamore		
Mod	4: Sunset		
Mod	3: Kachina		

Compartment Assessment Ranking
Composite Compartment Assessment Rating

Rating	Compartment		
High	9: Oak Creek	Low	11: Beaver Creek
High	7: Rim	Low	1: Anderson
High	6: Ponderosa	Low	2: Kendrick
High	13: Blue - Mor - Pine		
High	5: Flagstaff		
Mod	10: Sedona - Verde		
Mod	8: Secret - Sycamore		
Mod	3: Kachina		
Mod	12: Long - Stone		
Mod	4: Sunset		

Appendix 8

After the Fire

AFTER THE FIRE…

Returning Resident

Safety

Tips

Ponderosa Fire Advisory Council

Fire Recovery Contacts

American

Red Cross	928-779-4594
AZ Department of Public Safety	928–773-3600
Arizona Public Service	*928-779-6911*
Citizen's Arizona Gas	928 774-4592
Coconino County Animal Shelter	928-526-1076
Coconino County Emergency Services	928-526-2735
Coconino County Sheriff Department	928-774-4523
Coconino National Forest	928-527-3600
FEMA Help Line	1-800-621-FEMA
Flagstaff Clean & Green (Haz Waste)	928-779-7622
Flagstaff Fire Department	928-779-7688
Flagstaff Medical Center	928-779-3366
Flagstaff Police Department	928-774-1414
Flagstaff Water/Sewer	928-779-7646
Highlands Fire Department	928-525-1717
Parks-Bellemont Fire District	928-635-5311
Pinewood Fire District	928-286-9885
Summit Fire District	928-526-9537
US West (residential)	800-244-1111

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Fire Recovery Safety Tips

REMEMBER – *use caution and good judgment. Hazards may still exist, even though the fire is controlled.*

ELECTRICAL

Electrical Safety Facts

General: An important part of the disaster recovery is hazard recognition. Should you come across damaged or fallen power poles or lines, contact your local electrical power authorities. DO NOT TOUCH THE DOWNED WIRES. In the cleanup area, be especially careful when cutting trees and operating heavy equipment around power lines. Vegetation and power poles may have lost stability due to fire damage.

If a power line or pole should fall next to you while working in the area, *do not walk – hop out of the area.* (Using this technique, you will be less likely to be a conductor of electricity).

Electricity is always trying to go somewhere. It goes easily through conductors; it does not go easily through non-conductors.

Conductors	Non-Conductors
Metal	Rubber
Water	Glass
Wet Things	Plastic
Things In Water (including animals/pets)	

One of the most important fixtures in the conduction of electric current are utility poles. The fire or fire suppression actions may have dislodged or broken some of these poles, causing the wires to sag or break, resulting in extremely hazardous conditions. ***Do not touch anything at the scene*.**

Trees can also be dangerous conductors of electricity. When a tree falls or grows into contact with power wires, the electric power diverts and finds a path to the ground through the branches and the trunk. Anyone who comes into contact with these trees is subject to tragic consequences, since electric power can easily jump from the tree to the person.

Electrical Safety Tips

- **Do not overload circuits; don't operate several large appliances at the same time on the same circuit.**
- **Do not use extension cords to plug in many items on one outlet.**
- **Turn off appliances when you finish using them. Provide adequate air circulation around all appliances to prevent over-heating. Keep appliances clean, repaired and serviced.**
- **Check wires and plugs regularly. Replace worn or frayed wires. Do not run cords under carpets or across doorways.**
- **Be careful when replacing fuses or breakers. Keep the area near the circuit box dry and turn the main switch off before changing the fuse/breaker.**
- **Temporary lines should be removed from service.**

Electrical Locations To Avoid

- **Electrical meters and service lines coming into the home or other outbuildings.**
- **Any power supply line which appears to sag, show bare wire, or have insulation missing.**
- **Secured power sub-stations or any area identified as high voltage.**
- **Downed power lines.**

Emergency Procedures for an Electrical Fire

- **Call the fire department.**
- **Shut off power supply at the breaker if possible.**

Restoring Electric Power

If, upon returning to your residence, there is no electrical power, please check to make sure the main breaker is on. If the breakers are on and power is still not present, please call to report the power outage to your local electrical power authorities. Reporting problems like a down or broken wire will speed up the process of power restoration.

- **Stand off to one side of the breaker box when turning on the main breaker.** ***Do not stand directly in front of the box.***
- **If any smells of hot electrical insulation or sparking occurs,** ***turn of the breaker immediately and call an electrician.***
- **If electrical lights or appliances appear brighter than normal, turn off main breaker**. ***The service entrance needs to be checked.***

To Change A Fuse

Try to find the cause of the blown fuse, and correct it by disconnecting the defective appliance or appliances causing the overload or short circuit. Shut off the main power switch when you change the fuse.

- **Do not replace fuses with a higher amp rating fuse than you removed.**
- **Turn on the main switch to restore the power.**
- **If the fuse blows again, leave it alone and contact a certified electrician. Other problems may exist and should be investigated to remove the possibility of an electrical fire.**

To Reset A Circuit Breaker

Try to find the cause of the overload or short circuit and correct it by disconnecting the defective appliance or appliances. Turn the switch to "on" to reset and restore power. If breaker trips again leave it alone, and contact a certified electrician. Other problems may exist and should be found to remove the possibility of an electrical fire.

Special Information of Fuses & Circuit Breakers

Fuses and circuit breakers shut off the current whenever too much current tries to flow through a wire because of:

- **A short circuit, possibly caused by a bare wire touching the ground;**
- **Overloading, possibly caused by too many lights or appliances on one circuit; or**
- **By defective parts in an appliance.**

Know where the main circuit or fuse box is located in your house. Be sure you can locate the main switch; it controls all of the power coming into the house and is usually inside the circuit box. In some cases, however, it may be located outside of the house. Fuse or circuit boxes generally are labeled to designate which area of the house the circuits or fuses serve.

DRINKING WATER

Restoring Water Systems

Unless impacted by a fuel spill, the fire should not have affected wells at undamaged homes. If your house was damaged, your water system may potentially have become contaminated with bacteria due to loss of water pressure. In this case it is recommended that the well be disinfected and the water be tested before consumption. To disinfect your water system, pour ½ - 1 cup of chlorine bleach inside the

well casing and turn on all faucets until a chlorine scent in noticed. Allow the chlorine solution to remain in the system overnight. The following morning, open all faucets and flush the system until free of chlorine smell.

If you have a public use well or water system, contact the County Health Department for specifics on testing prior to consumption of any water.

SOLID WASTE

Removing Debris

Cleanup of your property can expose you to potential health problems from hazardous materials. Wet down any debris to minimize health impacts from breathing dust particles. The use of a two-strap dust particulate mask with nose clip and coveralls will provide the best minimal protection. Leather gloves should be worn to protect your hands from sharp objects while removing debris.

Hazardous materials such as kitchen and bathroom cleaning products, paint, batteries, contaminated fuel and damaged fuel containers must be handled properly. Contact the City of Flagstaff or Coconino County for specific handling restrictions and disposal options.

All hazardous materials should be labeled as to their contents if known!

HEATING FUELS

Checking Propane Tanks

Propane suppliers recommend homeowners contact them for an inspection prior to reusing their system. If the fire burned the tank, pressure relief valve probably opened and released the contents of the tank. Tanks, brass and copper fittings, and lines may be heat-damaged and unsafe. Valves should be turned off and remain closed until the propane suppliers inspect the system.

Checking Home Heating Oil Tanks

Heating oil suppliers recommend homeowners contact them for an inspection prior to reusing their system. The tank may have shifted or fallen from the stand and fuel lines may have kinked or weakened. Heat from the fire may have caused the tank to warp or bulge. Non-vented tanks are more likely to bulge or show signs of stress. The fire may have loosened or damaged fittings and filters. If the tank is in tact and heating oil remains in the tank, the heating oil should still be good. If you have questions on the integrity of the tank, fuel lines, tank stand, or the fuel, or need assistance in moving the tank or returning it to service, contact your fuel supplier.

MISCELLANEOUS SAFETY AWARENESS

Ash Pits

Holes created by burned trees and stumps create ash pits, which are full of hot ashes. Mark them for your safety, as they can stay hot for many days following the fire, causing serious burns. Warn your family and neighbors, especially children. Tell them to watch for ash pits and to not put hands or feet in these holes—they are hot!

Evaluation of Trees Damaged by Fire

The following information will assist you in evaluating any trees that have been scorched or burnt by the fire. Identification of the type of tree affected is important and can easily be done. Two basic types of trees exist in this area: deciduous and evergreen. Deciduous trees are broad leaf trees that lose their leaves in the fall.

In this area we have quaking aspen (deciduous). Evergreen trees have needles and in this area we have ponderosa pine, Douglas-fir and Rocky Mountain juniper.

First: ***visually check the tree stability.*** **Any tree weakened by fire may be a hazard. Winds are normally responsible for toppling weakened trees. The wind patterns in your area may have changed as a result of the loss of adjacent tree cover.**

If the tree looks stable:

- **Visually check for burnt, partially burnt or broken branches and tree tops that may fall.**

- **Check for burns on the tree trunk. If the bark on the trunk of the tree has been burned off or scorched by very high temperatures completely surround the tree's circumference, the tree will not survive. This is because the living portion of the tree (cambium) was destroyed. The bark of the tree provides protection to the tree during fire. Bark thickness varies based upon tree species: check carefully to see if the fire or heat penetrated the bark. Where fire has burnt deep into the tree trunk, the tree should be considered unstable until checked.**

- **Check for burnt roots by probing the ground with a rod around the base of the tree and out away from the base several feet. The roots are generally six to eight inches below the surface. If you find that the roots have been burned you should consider this tree very unstable; it could easily be toppled by wind.**

If the tree is scorched

A scorched tree is one that has lost part or all of its needles. Leaves will be dry and curled. Needles will be a light red or straw colored. Healthy deciduous trees are resilient and may possibly produce new branches and leaves, as well as sprouts at the base of the tree. Evergreen trees, particularly long-needled trees, may survive when partially scorched. An evergreen tree that has been damaged by fire is subject to bark beetle attack. Please seek professional assistance concerning measures for protecting evergreen trees from bark beetle attack.

Seek professional assistance before felling trees near power lines, houses or other improvements.

Residual Smoke In Fire Interior

Smoke may be present on the interior of the fire for several days following containment. This occurs as a result of stumps, roots, and other surface materials being exposed to changing temperatures and wind conditions. Smoke volume from these materials may fluctuate depending on weather conditions. This activity should not pose a risk and smoke will continue to dissipate until materials are fully consumed or extinguished by fire crews or weather.

Appendix 9

GFFP Monitoring & Research Team
Adaptive Management Framework

GFFP Monitoring & Research Team
Adaptive Management Framework

Discussion Draft 10/01/04

The following tables were developed by the Greater Flagstaff Forests Partnership (GFFP) Monitoring and Research Team as the initial makings of a monitoring and research plan for the 180,000 acre project area of the GFFP (see www.gffp.org). This framework could be applied to a smaller or larger landscape. The following five broad areas of concern reflect the monitoring needs categories of this partnership, and are divided into **fuels reduction, ecosystem restoration, social issues, economic health, and institutional health**. This is a very broad framework of what areas **COULD** be monitored within the larger area. The actual application of what **SHOULD** be monitored within individual projects may be a much smaller, and more focused subset of these variables. Decisions about which goals are desirable for individual projects should be decided by the actual project designers (e.g., ID team), and determined based upon very specific project objectives, the specific landscape that is affected by the project, the desired conditions for that landscape, and how those desired conditions are proposed to be achieved. Also, an explicit relationship needs to be developed between an analysis of the outcomes of the monitoring, and how those outcomes affect future management.

GOAL: Reduce threat of uncharacteristic* fire)

Objective	Indicator	Metric	What are known thresholds?	Frequency	Scale (spatial and temporal)	Cost L - <$1000/yr M - $1K-10K/yr H - >$10K/yr
Create conditions that are conducive to the increased use of **frequent, low intensity fire*** in the fire-adapted landscape, including fires resulting from both human and natural	1. Forest Vegetation Simulator (FVS) with Fire & Fuels Extension. 2. Fire model (e.g. NEXUS or FLAMMAP) runs indicate that fuels reduction treatments are effective in	Canopy cover Stand height Crown base height Crown bulk density Deadwood fuel loading Litter, dead, and live fuels moisture levels.	Depends on fuel model, but thresholds exist for surface or ground fire, passive canopy fire, and active canopy fire.	Before and after treatments. FVS uses stand data typically collected by USFS personnel. FLAMMAP gives predictive ability; factor in continued treatment.	Project and roll up to landscape	H

ignitions.	reducing the risk of active and passive canopy fire*. 3. Cumulative acres in characteristic and uncharacteristic fire condition 4. Fire Regime Condition Class 5. # of acres in Fire Use plans. 6. # of acres where "monitoring" or containment is considered an appropriate suppression tactic.	Annual reports of acres treated. ForestERA analysis process.				
Reduce risk of **uncharacteristic*** fire for community protection and other special areas.	Ditto above					

- For terms marked with an asterisk, please see glossary at end of document for current definitions and references, or click on hyperlink.

References: Brown 1974, Anderson 1978, Scott 1999, http://fire.org/nav.mas?pages=fire&mode=14; http://www.frcc.gov/

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GOAL: Restore Forest Ecosystem Health

Objective	Indicator	Method or Metric	Frequency	Scale (spatial and temporal)	Cost
Increase use of frequent, low intensity fire in the landscape (or ponderosa pine and	1. Number of acres that will support a surface fire. 2. Number of acres	USFS, State/Private, county, and city review of accomplishments (units in ac/ha and # of	Annual & cumulative	Project & Landscape Short & Long-term	L if fuels reduction monitoring is done

associated ecosystems). Improve fire regime*.	burned by characteristic* surface fire (both Rx and wildfire individ. And combined). 3. Number of Rx fires.	burns). List by FY and CY.			
Create conditions that are conducive to the increased use of frequent, low intensity fire in the landscape.	1. Number of acres that will support a surface fire.	See above in **Fuels Reduction**	Annual & cumulative		L
Retain, enhance, and develop old and large trees*, both living and dead, and mature ecosystems.	1. Number of old/large trees/acre. 2. Number and decay class of snags & dead/down trees/acre. 3. Number of acres of existing and developing old growth* ecosystems.	USFS and Partner surveys of trees per acre by stand. Cumulative survey of OG areas.	Before and after projects	Project scale rolled up to landscape level.	L at project H at landscape
Conserve and enhance native species*' populations and their habitat and reduce invasive, nonnative species*.	1. Abundance, distribution & diversity of selected native species. 2. Abundance, distribution & diversity of nonnative selected species. 3. Number of acres of intact native habitat*.	Species transects and quadrats, point-intercept data and time-constrained sampling in selected areas and for selected species. USFS surveys	Before and after treatment/projects, annual/seasonal.	Project scale rolled up to landscape level.	H
Conserve soil resources.	1. Degree of erosion 2. Amount of bare ground.	Field surveys	Before and after projects		M?

Maintain and improve watershed function.	1. Amount of water flow, timing (hydrograph), and water quality. 2. Degree of erosion & sedimentation.	Stream gages, direct water sampling, geomorphology measures.	Before and after projects, Annually		M

*For words underlined and marked with an asterisk, please see glossary.

References: Harrington, Michael G.; Sackett, Stephen S. 1992, Coconino LMP 1987; Pellant et al. 2000, Pyke et al. 2002; Herrick et al. 2002 (Jornada experimental range); Taylor 1999, O'Dea 2003;

GOAL: Improve Social Understanding & Acceptance of Land Management Practices

Sub goal: MAINTAIN QUALITY OF LIFE

Objective	Indicator	Metric *Measured as baseline data →* *for pre-treatment and measured at post-treatment*	Frequency	Scale *Project vs. GFFP Area*	Cost (H, M, L)
Reduce the perceived risk of uncharacteristic (high intensity) fire.	Perceived risk/threat of uncharacteristic (high intensity) wildfire that will directly or indirectly affect residents' quality of life.	1. Survey residents to determine the perceived risk/threat of uncharacteristic (high intensity) fire. 2. Focus groups during GFFP field trips/presentations.	Pre- and Post-treatment surveys/focus groups	Short term-Project Long term-GFFP area	M
Increase the perceived benefits of characteristic (frequent, low-intensity) prescribed and natural fires.	Perceived benefit of characteristic (frequent, low-intensity) prescribed and natural fires that will directly or indirectly affect residents' quality of life.	1. Survey residents to determine the perceived benefit of characteristic (frequent, low-intensity) prescribed and natural fires. 2. Focus groups during GFFP field trips/presentations.	Pre- and Post-treatment surveys/focus groups	Short term-Project Long term-GFFP area	M
Reduce the risk of uncharacteristic (high intensity) fire.	1. Fire model 2. Defensible space.	1. See "Fuels Reduction" metrics 2. Amount of defensible space around neighborhoods/homes.	Pre- and Post-treatment; Seasonally (bi-annually or quarterly)	Short term-Project Long term-GFFP area	H
Increase/maintain public's perception of recreational opportunities, in the context of restoration activities, in the local community.	Public perception of access and level of use for recreational activities in the forests in and around the local community (in the context of restoration activities).	Survey residents to determine perception of recreational opportunities in the forests in and around the local community (in the context of restoration activities).	Pre- and Post-treatment surveys	Short term-Project Long term-GFFP area	M
Protect/promote the aesthetic value of the forest.	Public perception that restoration projects will/are preserving and promoting forest aesthetics in and around	1. Survey residents to determine perception of the effects of restoration efforts on forest aesthetics in and	Pre- and Post-treatment surveys/focus groups	Short term-Project Long term-GFFP area	M

	their community.	around their community. 2. Focus groups during GFFP field trips/presentations.			
Protect/promote spiritual value of the forest.	Public perception that restoration projects will/are preserving and promoting the spiritual value of the forest.	1. Survey residents to determine perception of restoration efforts in protecting the spiritual value of the forest. Over sample Native American members of the community. Conduct personal interviews/focus groups with Native American members of the community.	Pre- and Post-treatment surveys/focus groups	Short term-Project Long term-GFFP area	M
Reduce the number of unplanned human-caused forest fires in the GFFP area.	Number of human-caused fires in the forest in the GFFP area.	Forest Service logs of fire occurrences and the ignition sources.	Pre- and Post- program implementation	Long term-GFFP area	M
Public's perception of forest closures.	Public's knowledge of the reasons for forest closures.	Survey residents to determine knowledge of why forest closures occur; does the public link it to restoration activities?	Pre- and Post-program survey	Short term-Program Long term-GFFP area	M
Public's perception of forest restrictions.	Public's knowledge of the reasons for forest restrictions.	Survey residents to determine knowledge of why forest restrictions occur; does the public link it to restoration activities?	Pre- and Post-program survey	Short term-Program Long term-GFFP area	M

Sub Goal: INCREASE PUBLIC INVOLVEMENT IN RESTORATION EFFORTS

Objective	**Indicator**	**Metric** ***Measured as baseline data*** **→** ***for pre-treatment and measured at post-treatment***	**Scale** *Project vs. GFFP Area*	**Frequency**	**Cost** **(H, M, L)**
Increase the knowledge/ perception of "Fire Wise" principles/communities	1. Amount of public knowledge/perceptions of "Fire Wise"	Survey residents to determine the knowledge/perceptions of	Short term-Program Long term-GFFP area	Pre- and Post-program implementation	M

and implementation of defensible space.	principles/communities. 2. Public knowledge/perceptions of implementing "defensible space" (space near and around homes).	"Fire Wise" principles/communities and implementation of defensible space.			
Increase the number of <u>communities</u>* that are recognized as "Fire Wise" in the GFFP area.	Number of communities in the GFFP geographic area designated as "Fire Wise."	Determine number of communities in the GFFP region that are recognized as "Fire Wise" through certification of Firewise/Communites/USA. (Currently in AZ → Timber Ridge)	Long term-GFFP area	Pre- and Post-program implementation	H
Increase the number of neighborhoods/household s that are implementing "Fire Wise" principles around their homes.	1. Number of households that are implementing (the degree of) "Fire Wise" principles around their homes. 2. Number of neighborhoods that are implementing "Fire Wise" principles.	1. Survey residents to determine their level of implementing "Fire Wise" principles around their homes. 2. Interview fire station personnel in neighborhood/home assessments. 3. Review fire station field survey logs.	Short term-Program Long term-GFFP area	Pre- and Post-program implementation	M
Increase community involvement in restoration activities. Pay special attention to youth service corps programs that include middle-high school age students.	1. Number of GFFP sponsored workshops, field trips, etc. 2. Number of youth programs established by GFFP that promote involvement & education with restoration efforts. 3. Number of participants and/or groups attending GFFP events. 4. Number of service groups participating in GFFP events. 5. Attendance of GFFP meetings - public and GFFP members.	1. Review GFFP logs. 2. Review event coordinator logs.	Short term-Program Long term-GFFP area	Pre- and Post-program implementation	M

Improve public access and participation in forest restoration.	1. Public's perception of the ability to participate in restoration activities and forest planning. 2. Public's access to information pertaining to restoration activities. 3. Media types utilized to disseminate GFFP information. 4. Most common media sources used by the public to access restoration information.	1. Survey residents to assess their perceived ability to participate and obtain information regarding restoration activities and forest planning. 2. Review number and type of GFFP public announcements for restoration activities. 3. Survey public to determine most desirable media source(s) to access the information.	Short term-Program Long term-GFFP area	Pre- and Post-program implementation	M

Sub goal: INCREASE PUBLIC INFORMATION/SUPPORT FOR RESTORATION PROJECTS

Objective	Indicator	Metric ***Measured as baseline data →*** ***for pre-treatment and measured at post-treatment***	Scale *Project vs. GFFP Area*	Frequency	Cost (H, M, L)
Increase perceptions of "healthy forests" resulting from forest restoration activities that include characteristic wildfire, wildlife habitat and watershed function in and around communities/GFFP geographic areas.	Public perception of restoration activities resulting in "healthy forests" in and around their community.	Survey residents to determine perceptions of restoration activities resulting in a "healthy forest."	Short term-Program Long term-GFFP area	Pre- and Post-program implementation	M
Increase awareness/support/notification for restoration projects.	1. Campaigns that are in place as informational tools for restoration projects. 2. Number of public notifications that include: prescribed burns-posting signs, new releases, door-to-door in neighborhoods, public meetings, presentations to service clubs/organizations, press releases, development and distribution of material and participation of GFFP in community events.	1. Review number of GFFP sponsored workshop, field trips, etc. 2. Review of the number of community participants in the events. 3. Review number of public notifications for prescribed burns-posting signs, new releases, door-to-door in neighborhoods, public meetings, presentations to service clubs/organizations, press releases, development and distribution of material and participation of GFFP in community events. 4. Perform content analysis of campaign types and messages. 5. Conduct focus groups to assess perceived messages of GFFP literature.	Short term-Program Long term-GFFP area	Pre- and Post-program surveys/focus groups	M

Increase awareness/support for restoration projects.	1. Number and content of local publications, editorials and letters to the editor regarding restoration efforts (Non-GFFP members) 2. Number and content of USFS public comments.	1. Content analysis: review number and content of local publications, editorials and letters in to the editor regarding restoration efforts. 2. Content analysis/frequency of public comments submitted to the USFS	Short term-Program Long term-GFFP area	Pre- and Post-treatment/implementation	M
Increase public support for mechanical thinning, road construction, and smoke as necessary tools for ecological restoration.	1. Number of complaints to authorities regarding thinning, road construction and smoke resulting from a restoration project(s). 2. Number of complaints to authorities for faster and more efficient implementation of restoration efforts.	1. Examine local fire department and police logs. • Review type and number of complaints filed per restoration project. • Review number and type of requests to initiate or complete restoration projects.	Short term-Program Long term-GFFP area	Pre- and Post-program/treatment implementation	M
Improve awareness and public attitude towards partners & cooperators involved in restoration projects (e.g., USFS, ERI, NPS, GCT, TNC, Flagstaff Fire Dept., etc.).	Public's awareness and perceptions of GFFP partners and cooperators.	1. Survey residents to determine attitudes towards GFFP partners and cooperators in regards to their involvement in restoration efforts. 2. Focus groups of residents to determine attitudes towards GFFP partners and cooperators.	Long term-GFFP area	Pre- and Post-treatment surveys/focus groups	M
Decrease number of appeals and lawsuits filed against GFFP projects.	1. Number of appeals of GFFP supported projects. 2. Number of lawsuits of GFFP supported projects. 3. Number of acres analyzed and treated through the NEPA process.	1. Review appeals to determine number filed against GFFP projects. 2. Review lawsuits to determine number filed against GFFP supported projects. 3. Review the results of the	Short term-Program Long term-GFFP area	Pre- and Post-program implementation or annual	M

		appeal. Was it upheld? 4. Length of time it took the agency to process the appeal.			
Increase public's knowledge of ecologically-based fuels reduction.	Public's knowledge of ecologically-based fuels reduction.	1. Survey residents to determine knowledge of ecological-based fuels reduction. 2. Focus groups during GFFP filed tips/presentations	Short term-Program Long term-GFFP area	Pre- and Post-program surveys/focus groups	M

Steps in the Evaluation Process

Longitudinal Study – Process Evaluation – assess changes over time.

1. Collect baseline data-establish an understanding of what currently exists; before intervention (treatments or programs).
2. Collect data at stages as projects progress; either at regular time intervals or after major interventions.
3. What is the change from pre- to post-test? Analyze the data.
4. Answer the question – Have goals been met? Establish criteria for successful outcomes.
5. Recommendations – refine treatments and programs; guide planning and education efforts.

A sustainable community is linked to a sustainable ecosystem.

Healthy forest → Community well-being.

Areas to explore

1. Insurance industry – current status of homeowner insurance for forest fire loss.

2. USFS and congressional representatives – determine public pressure thresholds to either suspend or omit restoration prescriptions.

References

Greater Flagstaff Forest Partnership and The Ponderosa Fire Advisory Council. 2004. *Greater Flagstaff Community Wildfire Protection Plan.* Retrieved July 26, 2004 (http://www.gffp.org/docs/June_draft.htm).

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GOAL: Improve Economic Health of Community

Objective	Indicator	Metric /Method	Scale *Project vs. GFFP Area*	Frequency	Cost (H, M, L)
Ensure the availability of forest material at a sustainable and constant level to support <u>appropriate forest product</u> industries.	1) # of acres and total volume in long-term (10 years or greater) contracts in the Flagstaff region.	Annual review of acres/total volumes in long-term contracts provided by public agencies (USFS and State).	Multiple: local, GFFP, & w/in 150 miles.	Annual	L
Provide employment opportunities to Flagstaff area residents in forest restoration projects & forest product or other related industries.	1) # of employees in forest-restoration & product related companies in Flagstaff region. 2) Proportion of Flagstaff area residents (as % of total) employed by forest product and restoration-related companies. 3) Proportion of permanent to temporary employees in … 4) Number of locally owned businesses.	Annual surveys/questionnaires with all forest product companies utilizing small diameter material. GFEC collected data. NAU College of Business (Bank 1 center).	GFFP area of product/material distribution	Annual	L
Provide technical and professional training to Flagstaff area residents to work on forest restoration projects.	1) Number and duration of training events and programs per year. 2) # of participants in training events & programs/year. 3) Level of training (professional, technical, accredited, on the job).	Identify all area institutions providing professional training related to forest products and restoration. Annual survey of those institutions to count events, level of training, and participants.	GFFP area of product/material distribution. **Need help from economist on scale decision.**		L

Expand uses and products associated with small diameter material (SDM) and biomass.	1) Total number, size, and longevity of operational businesses utilizing small diameter material in Flagstaff area. 2) Total # of products and uses for SDM and biomass. 3) Total volume (cords) of small diameter material processed locally in Flagstaff area by businesses.	Annual surveys/questionnaire with all forest product companies utilizing small diameter material & biomass. GFEC, NAU, etc.			M
Flagstaff area = 150 mile radius					
Small diameter material = <16” **Need to define***					

GOAL: Institutional Health

Objective	Indicator	Method/Metrics	Scale *Project vs. GFFP Area*	Frequency	Cost (H, M, L)
Increase annual budget to facilitate forest ecosystem restoration	Annual budget of GFFP, with operations as %.	review of annual budget	All GFFP Area	Annual	L
	# of donors, gifts, grants & contracts awarded (public & private) reported by category.	review of development database	All GFFP Area	Annual	L
	# of 5-6 figure project budgets/grants by category	review of annual budget and/or development database	All GFFP Area	Annual	L
Increase satisfaction among partners with GFFP operations	partner satisfaction (strategic direction, conflict resolution, consensus building, etc)	Survey (D. Hospodarsky)	All GFFP Area	Annual	M
Maintain & enhance collaborative effort among partners	# of PAB members; PAB and work team participation and attendance; content analysis of meetings.	meeting minutes review	All GFFP Area	Annual	L, M

	# of independent projects between partners fostered by GFFP.	reports from partners	All GFFP Area	Annual	L
Achieve annual objectives & develop long term strategy	Proportion of annual goals & objectives achieved	annual objectives review and cumulative achievement of goals	All GFFP Area	Annual	L
	Long term strategic plan development and perception among members of its implementation.	creation of document, survey of members	All GFFP Area	Annual	M
Implement MOUs developed with USFS Cooperators (RMRS PNWRS, SRS, FPL, CNF)	% of "shalls" in MOUs followed	MOU annual reviews	All GFFP Area	Annual	L
Increase communication among GFFP partners and cooperators	Project updates are current Minutes are shared betw/ BOD and PAB, and among work teams Partners' perception of communication	Survey of minutes, website and partners	All GFFP Area	Annual	L M
Increase visibility of GFFP at regional & national level	# of visits to website, project areas, media hits requests for GFFP documents, presentations	web log, interviews, elected officials meeting, GFFP records	All GFFP Area	Annual	L

Partial Glossary for Greater Flagstaff Forests Partnership Research and Monitoring Team

Characteristic & Uncharacteristic– In ecological systems, this refers to whether or not a variable or condition of the ecosystem or its parts is included in what is known about its historic or natural range of variability, which may be specific

to a given geographic area. E.g., we know from tree ring studies around Flagstaff that the historic range of variability for low intensity fires for the period of 1500 to 1872 was 2-15 years. Thus fires that currently occur within that range are characteristic in frequency (see **Fire Regime**).

Crown Fire, Active and Passive -- This is a fire that travels from one crown (or treetop) to another in dense stands of trees, killing most trees in its path. However, even in intense crown fires, unburned strips may be left due to powerful, downward air currents. A passive (or dependent) crown fire relies upon heat transfer from a surface fire burning below the crowns. An active (or independent) crown fire does not require transfer of heat from below the crowns. Source: Barnes, Burton V., Donald R. Zak, Shirley R. Denton, and Stephen H. Spurr. 1997. Forest Ecology (4th Edition). John Wiley and Sons, Inc. New York, NY. p. 282. (see also **Surface Fire**)

Fire Regime -- A fire regime is defined according to fire characteristics such as intensity, frequency, severity, season, extent, duration, behavior, spatial distribution, and type of fire (see **Crown Fire**).

Fire Regime Condition Class (FRCC)-- - http://www.frcc.gov/

Surface Fire -- A fire that burns over the forest floor, consuming litter, killing aboveground parst of herbaceous plants and shrubs, and typically scorching the bases and crowns of trees. Source: Barnes, Burton V., Donald R. Zak, Shirley R. Denton, and Stephen H. Spurr. 1997. Forest Ecology (4th Edition). John Wiley and Sons, Inc. New York, NY p. 281 (se also **Crown Fire**).

Monitoring Cost Categories
L – Low = $1-1,000 per year or monitoring period/effort
M – Medium = $1,000 – 10,000
H – High = $10,000 - $100