

will change weather patterns and

increasingly influences wildfires.

Extreme weather events enhance

entrance opportunities for invasive

diseases and species that intensify

forest decline and impact the quality

and quantity of wildfires' fuel.

ecosystem resilience. It usually reduces a forest community's ability to sustainably respond to injury and disturbance, decreases diversity, diminishes capacity to retain and recycle minerals, and increases entropy (energy loss from the system)

Forest decline means a loss of



Incremental increases in atmospheric heat slow stratospheric jet streams and can bring devastating windstorms, persistent heat waves, and droughts or extensive, prolonged inundations.



Floods and deluge-induced

landslides produce barren soil

areas. Severe windstorms,

droughts, floods, heat waves,

and lightning-caused wildfire

create landscapes of dead,

dying, and stressed vegetation.

Once established, invasive plants, insects, and disease can spread into more robust ecological communities. Synergistic with Global Warming they can contribute to ecosystem decline in a number of ways.



First, invasive species can xperience "character release and rapid population growth when they encounter areas easily colonized (or massive new food supplies), few predators, and only weak competitors.

Foreign species and diseases

often invade and colonize these

stressed and ecological

destabilized areas because

ecosystem resilience and

community resistance has

diminished.



Also, managers, using tax money for

administration, planning, roads, and

timber extraction services, hoped

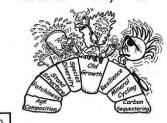
to retrieve the economic value of

the killed trees through "salvage

logging." However, market

conditions foiled management plans.

Second, invasive species may harm prominent, keystone species and favor usually rare native species that then proliferate and unravel the usual, stable, resilient, and sustainable ecosystem.



Fourth, invasive species may

incrementally contribute to

slow, cumulative effects that

reach a critical tipping point,

then suddenly destabilize plant

communities and increase

ecosystem decline.

Low intensity prescribed fire

every few years could eliminate flashy fuel and

potentially reduce severity in large fires. Fire-induced

nutrient release from foliage,

duff, and flashy fuel can

enhance plant and soil carbon

sequestration.

Fifth, when invading species favor fire-prone species, then the fire regime changes and landscapes may more frequently experience severe fires that aggravates ecosystem decline.

Third, in recently climate-

induced degraded

environments, invading plant

pathogens could symbiotically

associate with native insect

vectors to exacerbate

ecosystem decline.



Charrtoon #2. Global Warming Intensifies Forest Ecosystem Decline. February 2017.

Recent experiences with bark beetles provide heuristic similes. Although not an invasive species, climate change and naïve forest management allowed bark beetles to acquire an invader's



Warmer temperatures due to

climate change reduce beetles'

winter mortality. The higher

winter survival rate accentuated

incredible beetle population

growth that killed vast conifer

landscapes. Many feared severe

mega-fires would follow.

Over the last century, managed forests favored timber production and grew plantation-like stands. They favored large, uniform, and mature conifers maintained by industrialized harvest and fire suppression. Bark beetles prefer stands of low diversity with mature



However, not all beetle-killed forests experience high severity fire. In fact, most do not. Some beetle-killed areas even stop crown fires. The flashy fuel (aerated, unrotted foliage) can kindle and carry fires, but remains available to fires for only a few years.



Charrtoon #2. Global Warming Intensifies Forest Ecosystem Decline. February 2017.

Still, management responses intensified ecosystem decline.

Conflating total fuel with

conditionally available fuel, managers attempted to clearcut beetle-killed stands, cut in "protective fuelbreaks, and allowed other ecologically confused thinning projects.



Salvage logging squandered tax money, rivate investors, & ecologically injured ands. Global Warming makes clearcuts & plantations highly prone to intense & severe wildfires & landslides. Modern logging usually rely on lavish subsidies and rarely benefit local communities. Clearcut areas often eliminate options for tourism, recreation, & transition.



Instead of wasting money and by bark beetle outbreaks, invasive



resources on logging and mechanical thinning, prudent management looks to alternatives. Prescribed & Natural Fire Use remain the best methods to respond to ecosystem decline caused



Charrtoon #2. Global Warming Intensifies Forest Ecosystem Decline. February 2017. Costs of prescribed fire in remote, unbounded wildlands can be less than \$10 per acre. Suppose that prescribed fire near wildland-urban interface (WUI) zones costs \$300 per acre. Imagine using it on a perimeter acre of WUI that protects four adjacent landowners.



If each resident contributed an extra \$25 per year to their insurance premiums to be used for prescribed fire, then this acre could be treated every third year.

Imprudent responses to changed wildland conditions due to Global Warming include salvage logging, mechanical thinning, and spending millions to battle large wildfires. Natural fire use and prescribed fire remain the only inexpensive and viable responses to preserve wildlands' ecological services.

