MASSACHUSETTS FORESTS AT THE CROSSROADS

Forests, Parks, Landscapes, Environment, Quality of Life, Communities and Economy Threatened by Industrial Scale Logging & Biomass Power

Deerfield River, Mohawk Trail

Windsor State Forest, 2008, "Drinking Water Supply Area, Please protect it!"

MASSACHUSETTS FOREST WATCH

Wood burning biomass power plants are not clean and not "green" and should not receive public subsidies or construction permits. Cutting down forests or burning contaminated waste will not only seriously degrade our forests and air quality, but selling it as "green" and "clean" energy will add to public cynicism and threaten the important idea of using government subsidies to promote environmentally friendly technologies.

Current proposals for building 5 biomass plants would:

- **Target *public* forests to provide 532,000 green tons of wood annually, requiring clear-cutting 6,200 acres, or partially cutting between 11,000 and 31,000 acres each year. Historical 1980-2006 public land logging averaged 1,250 acres partially cut. See: www.maforests.org**
- **Target all forests to provide 1,900,000 green tons of trees annually, or 8.6 million trees. Forest cutting rates would more than triple on public and private forests. At this rate, all western and central MA forests could be logged in 16 years, or 9 years if protected areas are excluded. Heavy logging, including clearcutting, would become common. See: www.maforests.org/Impacts.htm**
- **Burn 2,500,000 green tons of wood and release 2,500,000 tons of CO2 emissions annually, causing a 10% *increase* over current statewide power plant CO2 emissions. Biomass power plants release 50% *more* CO2 per MWhr than coal and 150% more than gas. These biomass power plants are not carbon neutral despite such claims by proponents and the media.**
- **Increase air and water pollution in already polluted regions of Massachusetts. Ash from biomass power plants often contains lead and arsenic and is spread on farms as fertilizer.**
- **Require about 650 logging truck trips per day, or 200,000 trips per year, at about 5 miles per gallon for trips up to 100 miles, mostly on narrow rural roads and burn 5,000,000 gallons of diesel annually for cutting, chipping and trucking the wood.**
- **New power produced from these 5 plants would only increase generation capacity 1% more than today's capacity. Achievable conservation measures could reduce electrical use 30%. Conservation measures cost 3 cents per kWhr versus 9 cents per kWhr for new production.**

In order stop the threats to our environment from these large wood burning power plants, biomass energy projects using whole tree wood chips or chemically contaminated construction and demolition waste, municipal solid waste, and waste pallets need to be removed from eligibility to receive subsidies or advancement from taxpayers, electricity rate-payers, or any agents of the Commonwealth.

At this time of ecological and economic crisis, there is no reasonable argument for forcing taxpayers to subsidize new polluting, CO2 emitting, forest devastating carbon based fuels for minimal amounts of power. These policies will worsen air pollution, increase greenhouse gas emissions, deplete forests and drain our public coffers, the exact opposite of what we need to be doing right now. These tax-payer subsidies and other incentives should be redirected toward truly green technologies to produce clean, non-carbon emitting energy, and local jobs.

Drinking Water Supply Area, Windsor State Forest, 2008

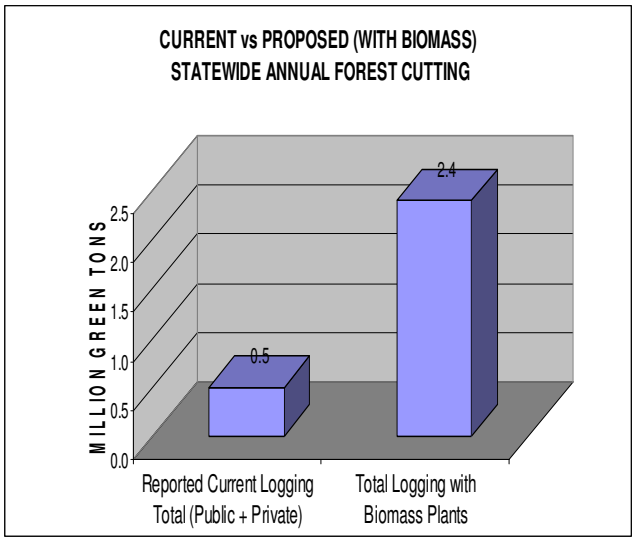
Additionally, Massachusetts has committed to reducing global warming emissions and burning millions of tons of forest will fly in the face of this effort and cause a double whammy by releasing currently locked up carbon as well as degrading the forests ability to absorb CO2. **Burning the forest is not "green" energy.**

For calculations, citations and links, see below

BURNING FORESTS FOR POWER IS NOT CLEAN NOR GREEN

Currently there are plans to build at least five, large-scale taxpayer subsidized, wood-fired biomass power plants in the western Massachusetts. (Greenfield, Russell, Springfield, Pittsfield and Fitchburg)[1] These proposals would require burning massive quantities of wood to provide minimal amounts of power and would worsen air and water pollution, add 2.5 million tons of carbon dioxide to the atmosphere annually,[2] divide communities, squander taxpayer dollars and heavily cut our important forests.

At least 2.5 million tons of wood, including 1.9 million tons of whole trees, or **8.6 million trees,** would be burned each year to fuel these large power plants.[3] For perspective, DCR records show current annual State forest land logging of 0.05 million tons of wood, and annual private land logging of 0.51 million tons.[3] Even when accounting for purported quantities of available waste wood and ignoring other biomass projects and serious proposals to cut trees for biofuels, **logging rates would more than triple** on all forests, public and private, in order to provide a continuous supply of wood.[3] **At this rate, <u>all</u> western and central MA forests could be logged in only 16 years, or 9 years, if protected areas are excluded**.[3] To deliver the wood, about **650 logging truck trips per day, or 200,000 trips per year** would occur on mostly narrow, rural roads**.**[3]



Claims that these plants will not use live trees and only burn clean waste wood is an "exploded myth"[4] which doesn't add up and is clearly false as demonstrated by the following facts.

The DCR maintains a "Marketing and Utilization" website promoting biomass power as having "*tremendous potential in Massachusetts due to the State's 3 million acres of "underutilized" forestland*" and has commissioned reports entitled "Forest Harvesting Systems for Biomass Production" and "Forest Biomass Harvesting-Silviculture and Ecological Considerations" which target public forests to provide biomass fuel.[5] This second report states "*the public forest land base for harvesting is 460,000 acres*" and "*the planned increase of biomass harvesting will be occurring in a region where forests are owned and managed largely for the ecosystem services they provide, such as habitat conservation, clean air and water, and recreation*" This report calls for 532,000 green tons of wood to be cut from **public lands** annually to fuel biomass power plants, meaning each year, 6,200 acres would have to be clearcut, or between 11,000 and 31,000 partially cut. This proposed logging would represent industrial scale cutting at rates **ten times** current cutting levels.[6]

Mass Audubon has warned the State that, *"the proposed Biomass Initiative targets raise concerns regarding potential effects on management not only of private lands but also for the commonwealth's publicly protected conservation lands, particularly the Department of Conservation and Recreation's state forests and parks."*[7]

In addition to the telling fact that there are already State forest timber sales to supply existing, relatively small biomass power projects,[8] the following disturbing House legislation (dropped, **for now**) is helpful for discerning the frightening effects wood-fueled biomass power could mean for Massachusetts forests.

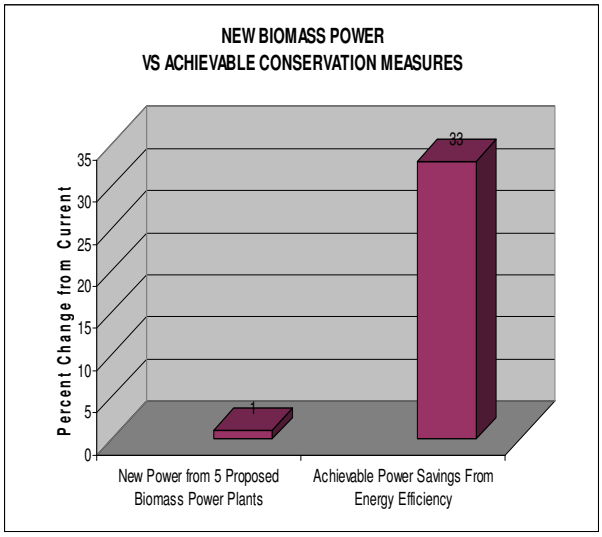
House 4373, An Act Relative to **Green** Communities, Section 71. *The department of clean energy shall, in consultation with the Department of Conservation and Recreation, a representative from the Bureau of Forestry, and the Department of Environmental Protection, commence a public rulemaking process no later than July 1, 2008, to* ***examine the use of non-sustainably harvested virgin wood as a biomass fuel*** *for inclusion in Class I and II of the Massachusetts renewable portfolio standard pursuant to section 11F of Chapter 25A of the General laws. Said process shall be complete on or before July 1, 2009.*[9]

Burning forests for energy is a step backwards and would worsen our environmental problems, not help solve them, particularly in light of increasing wood demands for heat and now serious proposals to turn large quantities of Massachusetts trees into biofuels.[10] In fact, a recent study by Stanford University has identified cellulosic ethanol (i.e. biofuel from wood) as the **worst** of the renewable energy options, **even worse than fossil fuels**. According to the report, ***"Ethanol-based biofuels will actually cause more harm to human health, wildlife, water supply and land use than current fossil fuels."*** [11] Interestingly, the highest paid state worker in Massachusetts is a biofuels specialist at the University of Massachusetts, with an annual salary of $613,000, more than 4 times higher than the Governor's salary.[12]

With already polluted skies and carbon dioxide levels dangerously increasing, it is irrational and reckless to chop down forests and burn them for minimal amounts of cheap power. To add insult to injury, public funds are being diverted from truly clean and green technologies to subsidize cutting and burning of trees, which will help foster a cynicism of "clean" and "green" in conscientious citizens growing increasingly wary of "greenwashing" by government and industry.

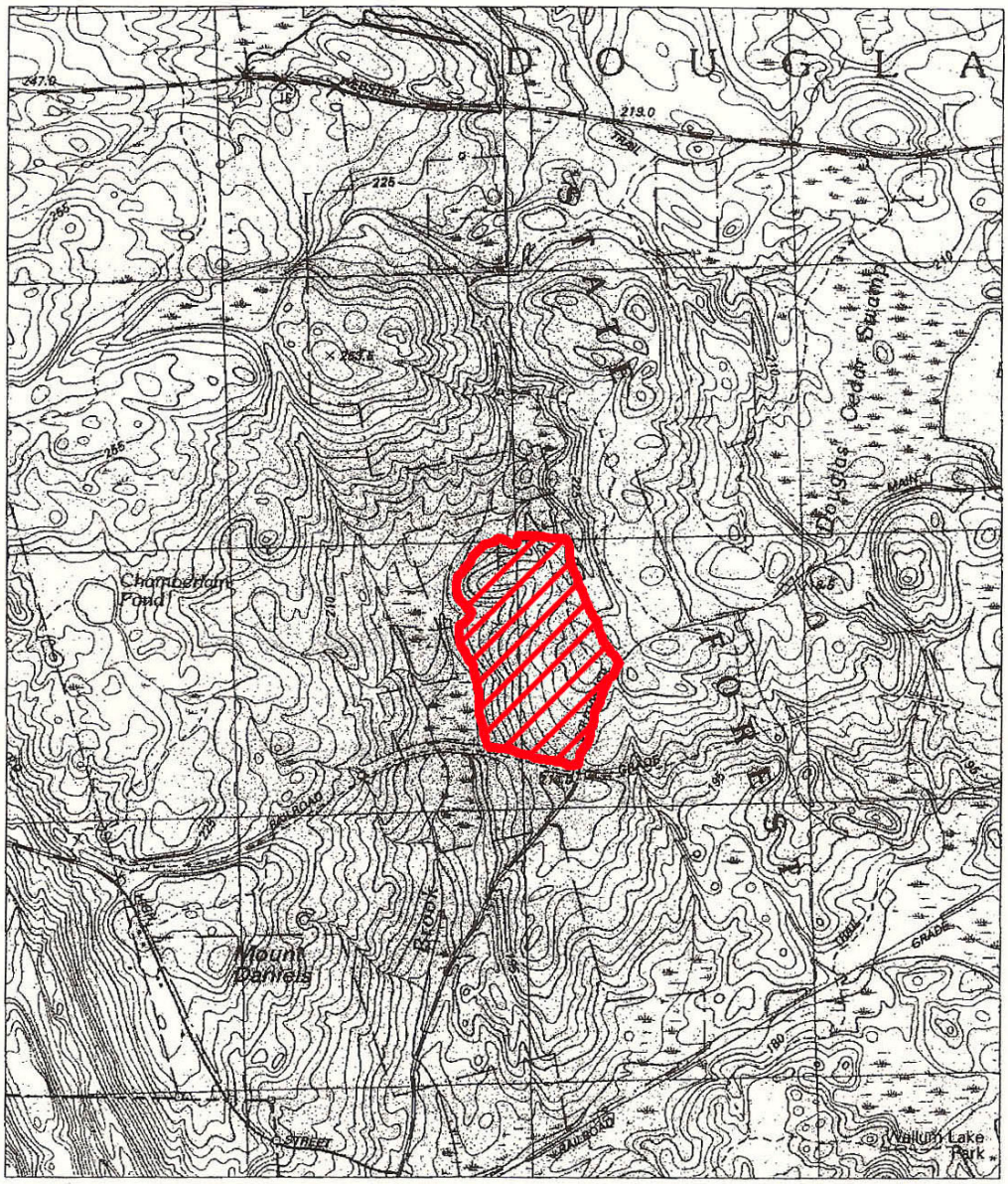
Building these plants would come with the many costs and consequences mentioned above yet would only provide 190 MW of power, a just over 1% increase on the current 13,357 MW generating capacity in Massachusetts.[13] Phantom loads, the loads drawn when electrical equipment is not even on, account for 5% of total electrical use and can easily be mitigated[14]. Overall, achievable efficiency measures could provide a 33% reduction in electricity use.[15]

40 MW Biomass Plant, Livermore Falls, ME



During this era of polluted skies, global warming, asthmatic children and government deficits, the last thing we need to do is build taxpayer subsidized biomass power plants that will lead to aggressive cutting, burning and inhaling of forests. We need to keep forests alive, growing and cleaning the air and water. A school child understands this concept, when will Governor Patrick's office of Energy and Environmental Affairs realize it? Instead, in their own words, they are "aggressively pushing" the development of biomass power.[16]

Imagine the folly of using a washroom electric hand dryer designed to save trees knowing that trees are being cut and burned to power the dryer, or faithfully recycling paper products to save trees knowing that 2 million tons of trees are being cut and burned each year.



Douglas S.F. Biomass Sale Locus Map

US State Plane 1983
Massachusetts Mainland 2001
NAD 1983 (Conus)

N

Scale 1:25,000
0 3,000
Feet

Rt-16.ssf
6/9/2008
GPS Pathfinder® Office
Trimble.

2008 BIOMASS TIMBER SALE
DOUGLAS STATE FOREST

Cutting and burning forests is not "green" energy

(Photos below of current clear-cut logging on state forests are a preview of the logging that would occur statewide to fuel large scale biomass energy and biofuels proposals)

Clearcutting Windsor Jambs State Park, 2008

Clearcutting Savoy State Forest, 2008

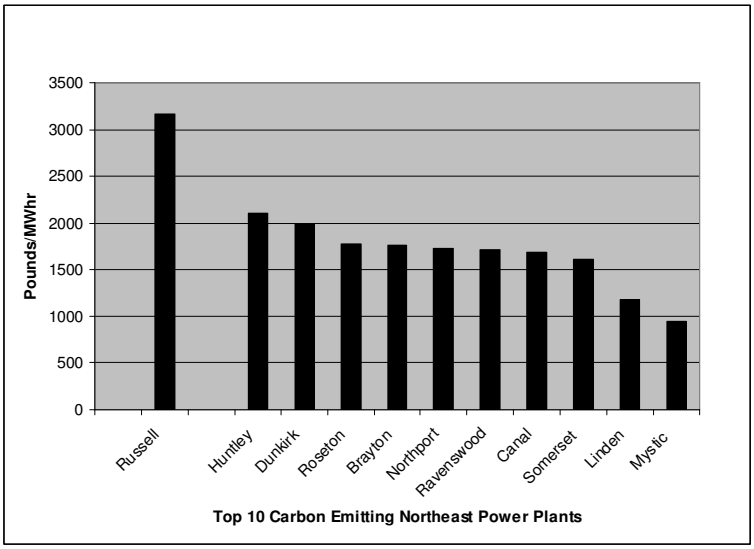
GLOBAL WARMING – LOGGING AND BURNING FORESTS AND CO2

Biomass is typically touted as a carbon neutral fuel and burning biomass is sold as "green" energy. The key assumption about carbon neutrality is unsubstantiated and impossible, yet is slavishly repeated by biomass proponents and the press. However, an awakening from this irrational wishful thinking is starting to occur. For example, the Massachusetts Department of Public Utilities in their recent partial rejection of Russell Biomass' request to overturn Russell's zoning bylaws, wrote that uncertainties about sustainability "prevent the Department from reaching a conclusion on the likely carbon impact of this facility."

As mentioned earlier, five large-scale biomass plants are proposed for Massachusetts which would **add 2.5 million tons of carbon dioxide annually into the atmosphere, or a nearly 10% *increase* in statewide power plant CO2 emissions.**[17] If the fuel to cut, chip and transport the wood were included, this number is even higher. However, the carbon impacts are actually worse because now the forest's ability to sequester carbon has been reduced and the forest root systems will decay and release additional stored carbon.

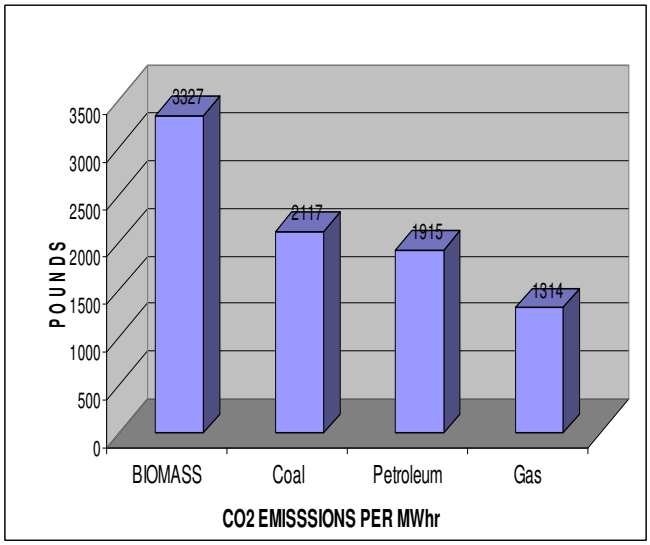
Russell biomass is one such proposed facility. The project proponents estimate in their Expanded Environmental Notification Form (EENF) that the plant will emit 1,732 tons per day of carbon dioxide, or 3,327 lbs/MWhr.[18] **This means the Russell plant would release 50% more CO2 per unit energy produced than any of the worst carbon dioxide emitting power plants in the Northeast.[19] Overall, biomass power plants release 50% more CO2 per MWhr than coal and 150% more than gas.[20]**

RUSSELL BIOMASS
Vs
WORST NORTHEASTERN POWER PLANTS



Source: MassPIRG "More Heat than Light"

BIOMASS POWER
Vs
FOSSIL FUELS



Source: Department of Energy

In sum, the CO2 increases from these plants include emissions from petroleum based logging of massive amounts of forest, chipping the wood, hauling it up to 100 miles in trucks that get about 5 miles per gallon, building a $150 million facility and then burning the wood at only 25% efficiency. Additional long-term CO2 increases are caused by a reduction in the forests ability to sequester carbon and the decay of the forest root systems. **It is impossible for this facility, or others like it, to be carbon neutral because it would require *instantaneous* forest growth to replace what is cut and burned**. **Furthermore, any increase in forest cutting negatively affects the *current baseline condition* of forest growth versus cutting and mortality. Carbon neutrality of a project requires no net change to this ratio.** Clearly, allowing the maximum forest growth rate possible is the best option for improving atmospheric CO2 levels.

Russell biomass and similar large biomass projects are a lose-lose-lose-lose proposition that would increase air and water pollution, release excessive carbon dioxide to the atmosphere, put harmful logging pressures on our carbon dioxide-sequestering forests and squander taxpayer clean energy funds.

Deforestation is a major contributor to greenhouse gas emissions. In fact, the United Nations Food and Agriculture Organization reported in October 2006 that deforestation accounts for 25 to 30 percent of the release of greenhouse gases. The report states: "*Most people assume that global warming is caused by burning oil and gas, but in fact between 25 and 30 percent of the greenhouse gases released into the atmosphere each year – 1.6 billion tons – is caused by deforestation.*"[21] While less destructive, even selective logging adds carbon to the atmosphere.[22]

According to a study by a Deutsche Bank economist that was commissioned by the European Union, "*the global economy is losing more money from the disappearance of forests than through the current banking crisis*" and that the "*losses are great, and continuous*"[23] The report estimates that the annual cost of forest loss at between $2 trillion and $5 trillion from quantifying the value of the various services that forests perform, such as providing clean water and absorbing carbon dioxide. It projects that forest decline could be costing about 7 percent of global Gross Domestic Product and that the greatest cost to western nations would initially come through losing a natural absorber of the most important greenhouse gas. The report refers to temperate as well as tropical forests.

Recent research shows that forests that have a past history of logging have less ability to sequester carbon dioxide than unlogged forests. Other research shows that biofuels such as ethanol have very negative impacts and consume more energy (in the form of petroleum inputs) than they generate.[24] A similar analysis of biomass is sorely needed before we charge ahead with these facilities that drive heavy logging that could take decades to recover from. It may turn out that our best alternative is to leave the forests alone. If they have been destroyed before we do an analysis, we may have lost our best option through carelessness and haste. In order to put some brakes on this runaway train, a moratorium on commercial logging of State forests should immediately be implemented and taxpayer subsidies for large biomass plants should be halted.

Massachusetts likes to claim it is progressive in the arena of green and alternative energy, and has even passed a global warming bill committing itself to reducing carbon dioxide emissions. However, these efforts stand in stark contrast to the promotion of biomass technology that is based on combustion and emitting carbon which also damages carbon sequestration potential by cutting down trees. Massachusetts should be focusing efforts on low-carbon release technologies and energy conservation rather than subsidizing biomass projects with scarce taxpayer funds.

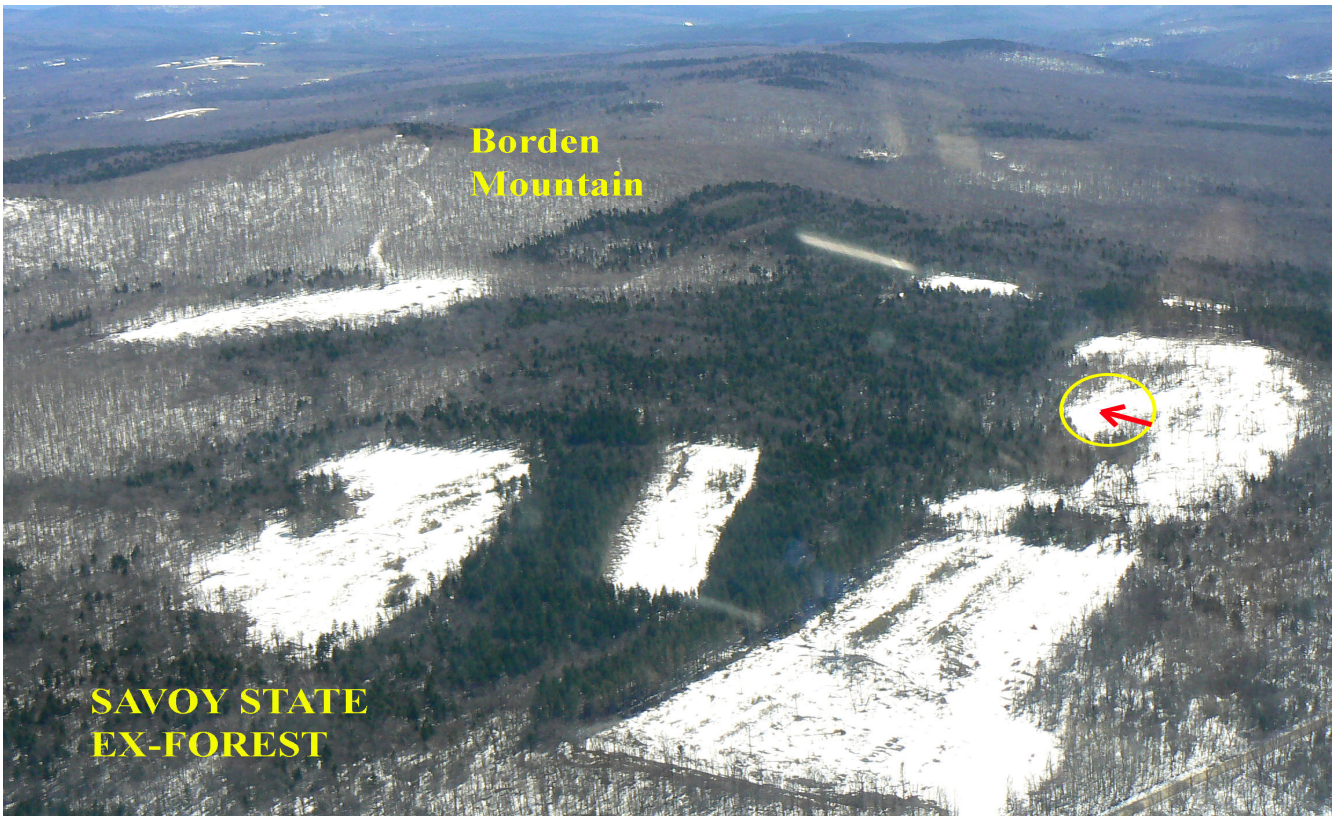
Carbon Neutral? Peru Wildlife Management Area, 2008

According to a 2007 Massachusetts Department of Energy Resources document, conservation is the cheapest form of energy, costing only 3.2 cents per kilowatt-hour versus 8.9 cents for new energy production, and furthermore, opportunities for conservation are substantial.[254] Solar, hydro, tidal, wind and geothermal energy are not based on combustion with its inevitable CO2 emissions. We need to pursue more advanced energy strategies and think bigger than heretofore. More significant change is needed than just a switch from one dirty combustible fuel to another, especially if we intend to leave a habitable planet for our children.

In light of these facts, it would be a huge mistake, crazy even, to cut down our trees and burn them in biomass plants. Many of the consequences of these irrational ideas would be difficult, expensive, and time-consuming to reverse. A course correction is urgently needed before too much damage is done.

"Savoy State Forest….over 50 miles of wooded trails invite year-round recreational access to spectacular natural features. Or climb up Spruce Hill on the Busby Trail for breathtaking views, especially during fall foliage and hawk migration."

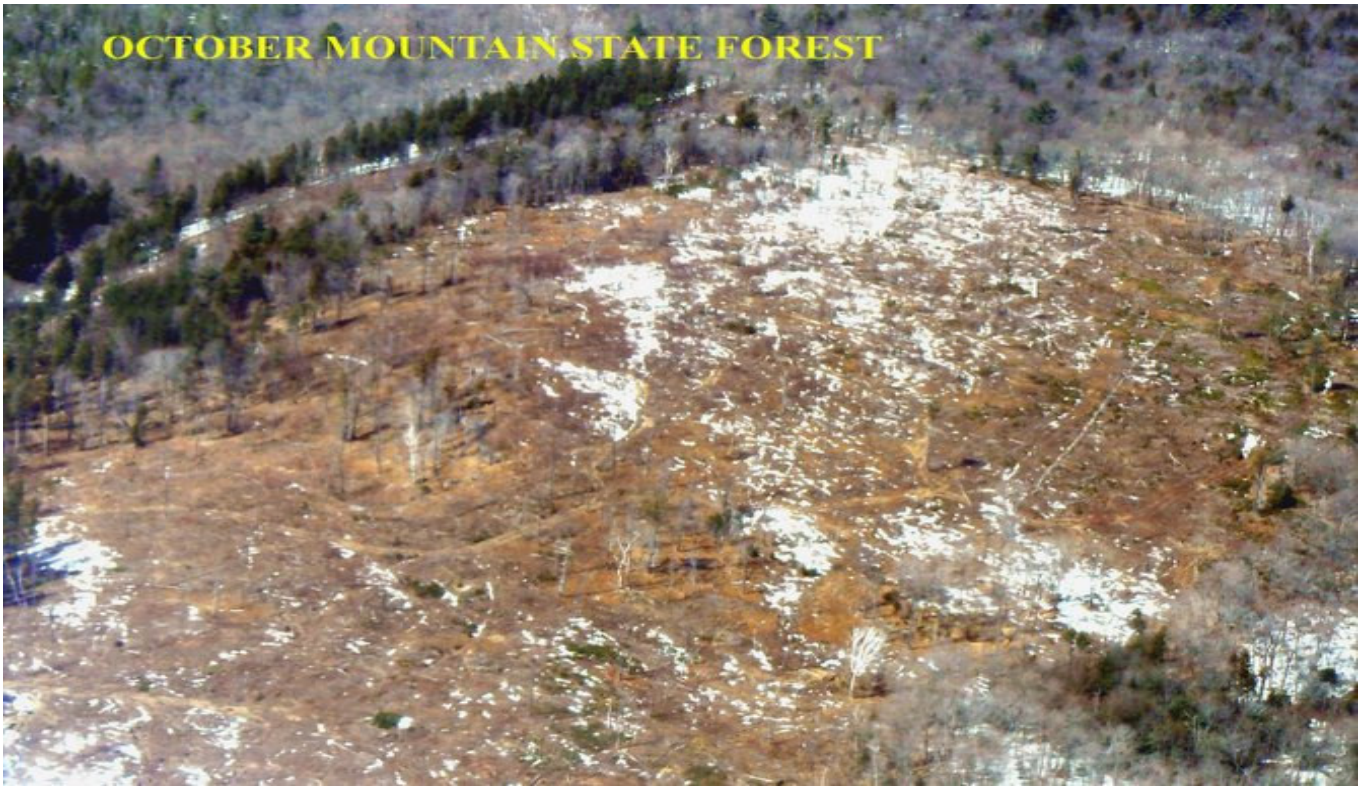
DCR Website



AERIAL VIEW, SAVOY STATE FOREST, NEW STATE RD, CLEARCUTS, 2008

GROUND VIEW OF LOCATION MARKED IN THE PHOTO ABOVE, 2008

"At 16,500 acres, October Mountain is the largest State forest in Massachusetts. Here visitors can camp, hike and enjoy the outdoors while they visit nearby Tanglewood and other Berkshire Region points of interest." **DCR Website**



County Road, October Mountain State Forest, Four Corner Area, 2008

West Branch Road, October Mountain State Forest, 2008

"Our State parks are a vital treasure for the Commonwealth. By the end of my administration, I hope each and every park is something that we can all be proud of"
Governor Patrick [11]

WINDSOR JAMBS STATE *PARK* – NEAR SCHOOLHOUSE ROAD, 2008

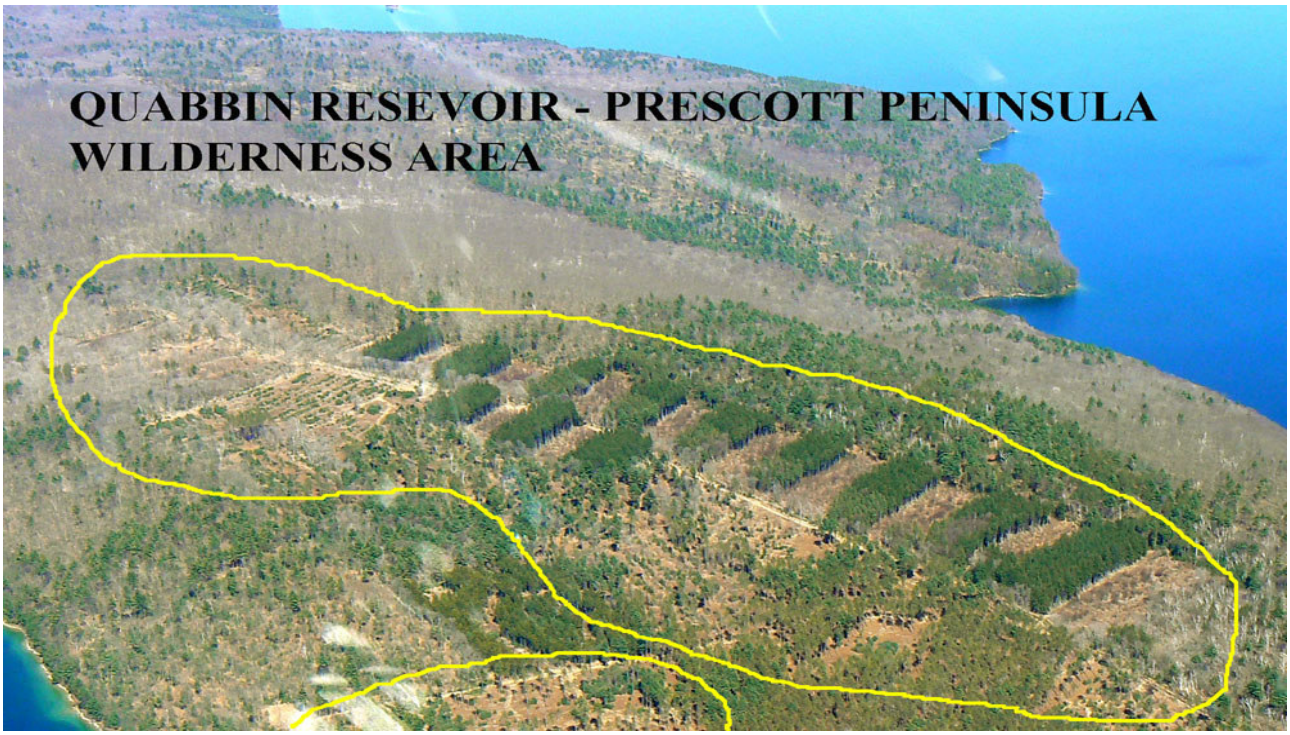
QUABBIN STATE *PARK* – NEAR VISITORS CENTER, 2008

"Savoy Mountain State Forest makes it easy to leave the everyday world behind. Scenic North and South Ponds, with wooded edges and hills rising in the distance, offer tranquil places to fish, picnic and swim" DCR Website

New State Road, Savoy State Forest, 2008

Aerial View of large 44 Acre Cut, Bannis Road, Savoy State Forest, 2008

The Quabbin Reservoir



Clearcutting the Prescott Peninsula Wilderness Area, 2008
Hiking is Illegal to Protect the Watershed

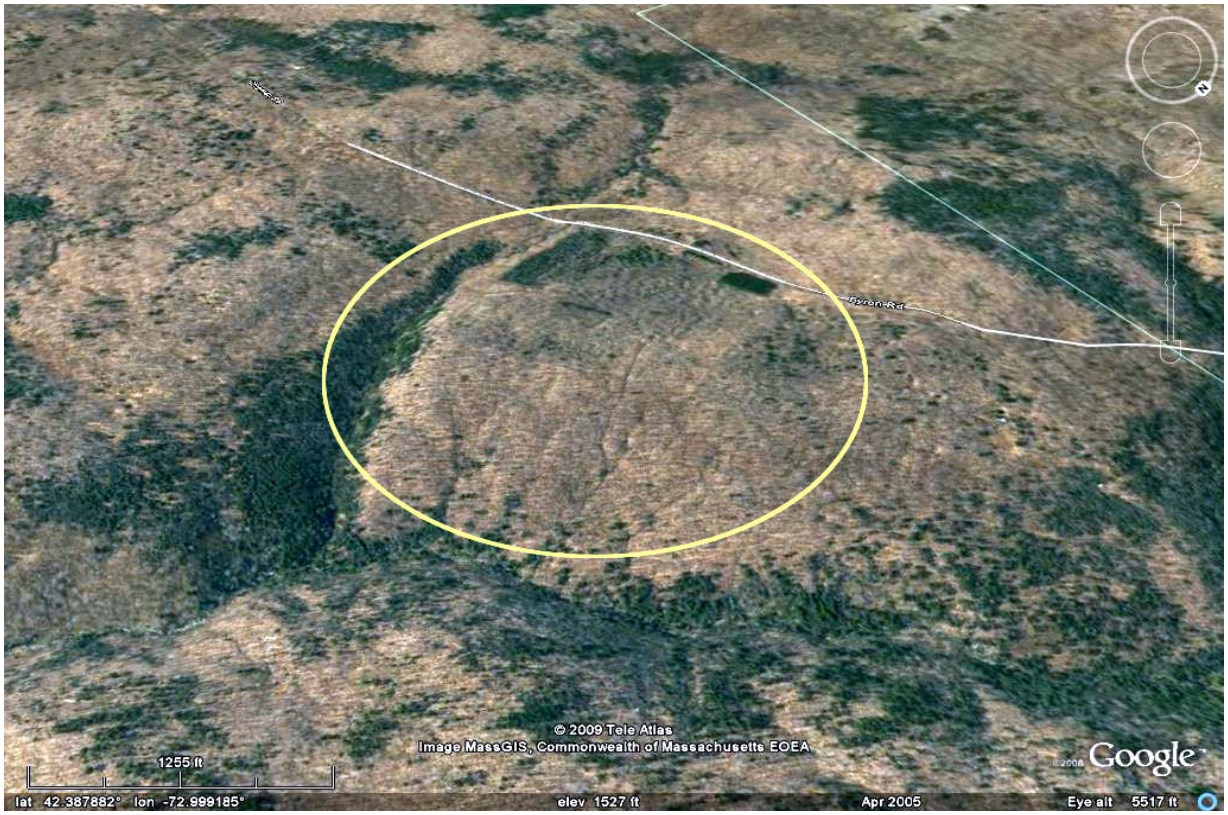
SR202 - 2007

Gate 31 - 2007

Gate 35 - 2007

SR202 - 2007

"The Massachusetts Division of Fisheries and Wildlife is responsible for the conservation - including restoration, protection and management – of fish and wildlife resources for the benefit and enjoyment of the public. **~DFW Website**



Google Earth "Before" photo of large, un-fragmented, interior, hardwood forest

Aerial View "After" photo of now fragmented, clear-cut forest, same location
Fox Den Wildlife Mgmt Area, Chipman Rd, March, 2008

Footnotes

1 www.masstech.org/project_list.cfm?init=40, www.recorder.com/story.cfm?id_no=5676106, www.wbjournal.com/news41145.html
Greenfield (47 MW), Russell (50 MW), Springfield (38 MW), Pittsfield (30-50 MW), Fitchburg (15 MW) = 190 MW

2 Biomass Data (www.mass.gov/Eoeea/docs/doer/renewables/biomass/bio-08-02-28-wmass-assess.pdf)
Page 11 - 13,000 green tons per year (at 90% capacity factor) = 1 MW generating capacity
→ Total Wood required = 190 MW x 13,000 tons = 2.47 million green tons
CO2 produced per green ton of wood at 45% moisture burned which combines oxygen =
1 green ton = 0.55 dry tons x 50% of weight is carbon = 0.275 tons of carbon per green ton
$C + O_2$ gives CO_2. By atomic weights, this is 12 + 32 = 44 → 1 + 2.67 = 3.67
→ 0.275 tons carbon x 3.67 = 1.01 tons of CO_2
Thus, 1 green ton of wood at 45% moisture creates 1.01 tons of C02
→ Total annual CO2 = 2.47 million green tons x 1.01 = 2.5 million tons of C02

3 Biomass Data (www.mass.gov/Eoeea/docs/doer/renewables/biomass/bio-08-02-28-wmass-assess.pdf)
Page 11 - 13,000 green tons per year = 1 MW generating capacity
Page 13 - Branches and tops add 0.29 tons for each ton of merchantable stems, leave 50% on ground, use 0.145 tons
Page 31 - Total Residue Available = 0.63 million green tons all western MA including Worcester County
NOTE: the reality of this number includes C&D waste (see page 25) and is likely to be significantly smaller as it does not account for reductions due to less land clearing due to the housing market correction, reduced timber residues due to the depressed industry conditions, or the removal of toxic C&D waste. Availability of out of state sources excluded due to their own demands from their own proposed biomass projects.
Existing wood cut on MA forests, 2005 Stakeholder Report (www.mass.gov/dcr/stewardship/forestry/)
Total public and private forest acres in Massachusetts = 3.1 million acres (Page 1)
Private Forests 5 year Average Annual Harvest (Page 10), 27,561 acres, 62,604 mbf, 44,806 Cords, 20,088 tons
Convert to tons, 1 cord = 2.5 green tons chips, 1 mbf = 5.0 tons (1 mbf = 2 cords)
→ 62,604(5.0)+44,806(2.5)+20,088 = 442,123 tons x 1.145 (branches and tops) = 0.506 million tons
Public Forests 2001-2005 Average Annual Harvest (Page 15), 1,417 acres, 5487 mbf, 3757 Cords, 2425 tons
Convert to tons, 1 cord = 2.5 green tons chips, 1 mbf = 5.0 tons (1 mbf = 2 cords)
→5487(5.0) + 3757(2.5) + 2425 = 39,253 tons x 1.145 (branches and tops) = 0.045 million tons
→0.506 million tons private + 0.045 million tons public = 0.55 million tons current total harvest
Note: DCR cutting is reported for logging projects over 25 mbf or 50 cords. Small projects are not reported and are difficult to ascertain quantities, add 20% to this quantity for small projects = 0.55*1.20 = 0.66 million tons
Total five plant Biomass Wood required = 190 MW x 13,000 tons = 2.5 million tons
Wood required from forests after subtracting available waste wood = 2.5 mil tons – .63 mil tons = 1.87 mil tons
Avg weight for trees too small for sawlogs= 434 lbs →1,870,000 tons x 2000 lbs / 434 lbs= 8,617,000 trees
www.fs.fed.us/ne/newtown_square/publications/research_papers/pdfs/scanned/OCR/ne_rp366.pdf p 2
Total proposed required harvest = (1.87 + 0.66)/0.66 = 3.83 times current rate
Total annual acreage cut at 3.83 times current rate = 3.83 x 1.2 x (27,561+1,417) = 133,183 acres per year
Years to log central and western MA Massachusetts forests, see: www.maforests.org/Impacts.htm
Truck Trips= 2.5 mil tons/25 tons per trip x 2 (2-way) = 200,000
Trips per day (6 working days per week) = 200,000 / (52*6) = 641, some trucks are not fully loaded, say 650
Diesel Required: 2 gallons per ton of wood cut, chipped and delivered, per John Clapp, ex-manager Pinetree Biomass Plant → 2.5 million tons wood x 2 = 5.0 million gallons of diesel
Ash from biomass power plants contains lead at 100 ppm and arsenic at 10 ppm and is spread on farms per per John Clapp, ex-manager Pinetree Biomass Power Plant

4 www.timberbuysell.com/Community/DisplayNews.asp?id=3638

5 www.mass.gov/dcr/stewardship/forestry/utilmark/index.htm

6 www.mass.gov/Eoeea/docs/doer/renewables/biomass/bio-silviculture.pdf
280,000 dry tons from 465,000 acres of public lands p 25
45 dry tons per acre from clearcutting, 9-25 dry tons per acre from partial cutting p 13
280,000 / 45 = 6,259 acres from cleracutting
280,000 / 25 to 280,000 / 9 = 11,200 to 31,100 acres for partial cutting
280,000 dry tons x 1.9 = 532,000 green tons. Current public land logging = 45,000 green tons, (see footnote 4)
532,000 / 45,000 = 11.8 times current rate

7 www.mass.gov/Eoeea/docs/doer/gca/class2/massaudubonreplyrps2.pdf p 3

Footnotes (Continued)

8 www.biomass.forestguild.org/Case-Studies/1035.html

9 www.mass.gov/legis/bills/house/185/ht04pdf/ht04373.pdf p 85

10 www.wpi.edu/Pubs/E-project/Available/E-project-042408-122534/unrestricted/April_24_draft.pdf

11 http://news-service.stanford.edu/news/2009/january7/power-010709.html

12 www.boston.com/news/local/massachusetts/articles/2009/02/11/umass_employees_top_list_of_highest_paid_state_workers/

13 www.eia.doe.gov/cneaf/electricity/st_profiles/e_profiles_sum.html 2007 capacity = 13,557 MW + new

14 http://sustainable.cchrc-research.org/2008/07/dont-let-phantom-power-haunt-your-home/

15 www.aceee.org/energy/eemra/eeassess.htm

16 www.mass.gov/Eoeea/docs//doer/pub_info/giudice-enr-testimony-feb-26-2009.pdf p 2

17 www.eia.doe.gov/cneaf/electricity/epa/epat5p1.html U.S. Electric Power Indust. Estimated Emissions by State (EIA-767 and EIA-906)
2006 Emissions = 23,707,577 metric tons x 1.1 = 26,078,000 tons → 2,500,000 tons new / 26,078,000 = 9.6%

18 Tighe & Bond. 2005. Expanded Environmental Notification Form, Russell Biomass Project, September 2005. p. 3, 12
1732 tons CO2 per day x 365 = 632,180 CO2 tons per year, 380,000 MWhr per year,
632,000 x 2000 lbs/ton /380,000 = **3,327 lbs of CO2 per MWhr**
Back check: 380,000/365 days / 24 hours / 50 MW x 100% = 86.7% uptime
50 MW x 13,000 green tons (at 90% up time) x 86.7 % / 90% x 1.01 tons carbon per green ton = 632,000 tons CO2 **OK**

19 Massachusetts Public Interest Research Group. 2005. "More Heat than Light." p 1
www.policyarchive.org/bitstream/handle/10207/5503/NE-More%20Heat%20Than%20Light%20text%20%2b%20cover.pdf?sequence=1

20 Department of Energy, Table-1 www.eia.doe.gov/cneaf/electricity/page/co2_report/co2emiss.pdf
Coal = 2,117 lbs CO2 per MWhr Petroleum = 1,915 lbs CO2 per MWhr Gas = 1, 314 lbs CO2 per MWhr
Biomass = 3,327 lbs per MWhr (see footnote 18)

21 www.fao.org/newsroom/en/news/2006/1000385/index.html

22 www.americanscientist.org/issues/pub/cant-log-the-forest-for-the-trees

23 BBC News, Oct, 08, Richard Black,"Nature Loss Dwarfs Bank Crisis" http://news.bbc.co.uk/2/hi/science/nature/7662565.stm

24 Lang, Susan, "Cornell ecologist's study finds that producing ethanol and biodiesel from corn and other crops is not worth the energy." Cornell News Service, July 5, 2005. www.news.cornell.edu/stories/july05/ethanol.toocostly.ssl.html

25 Massachusetts Saving Electricity: A Summary of the Performance of Electric Efficiency Programs Funded by Ratepayers Between 2003 and 2005. www.mass.gov/Eoeea/docs/doer/electric_deregulation/ee03-05.pdf p 1

MASSACHUSETTS FOREST WATCH

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