Summary of Biomass Burning Policy Breakout Group Discussion
Workshop on Short Lived Climate Forcers
Chapel Hill, NC
March 3-4, 2010

Introduction: Domestic and International Biomass Burning

- Smoke from biomass burning is a mix of particles with different chemical compositions, and gases, including NOx and reactive hydrocarbons that serve as precursors to the formation of tropospheric O_3. A significant fraction of the particles produced in the flaming and smoldering phases of biomass combustion contain graphic carbon and "brown" carbon. Both materials absorb solar radiation, and act to warm the atmosphere and reduce the surface albedo of ice and snow.

- This group discussion addressed the range of issues associated with reducing smoke emissions from wildfires, prescribed burning and agricultural burning to mitigate climate warming. Residential wood burning and cook-stoves were considered by other groups.

- Central points/issues:

    - Biomass burning is sometimes an essential tool, but it is always a climate, visibility and air pollution source. The challenge is to balance the need for burning to manage and restore land and forest resources, with climate/AQ/visibility protection.
        - Cyclic natural fire events are a necessary element for the well-being of some ecosystems.
        - Prescribed burning is needed to restore some forests that are suffering from unhealthy fuel loadings, due to decades of fire suppression and a changing climate.

    - Domestic and international policies/decision support structures/systems are *just* starting to include health effects and don't consider climate change

1. Can we **identify priority mitigation options in this sector** for light-absorbing carbon (LAC) and ozone precursors, considering cost, technological feasibility, ease of implementation, and effectiveness? **If so, what are they?**

No -- not with the information at hand. The existing programs and strategies for smoke management of which we are aware have been focused on protecting air quality in populated and Class 1 areas specified in the US Clean Air Act. The feasibility of expanding the use of emissions mitigation practices needs to be analyzed accounting for the known constraints (see "Design considerations," below). However, we identified priority regions for mitigation efforts and several necessary considerations for the design of a LAC and O_3 precursor emissions mitigation policy.

- Priority regions – In addition to areas such as those noted in the US CAA, areas upwind of arctic (high latitudes), mountain glaciers and snowpack (stored water supplies critical for regional ecosystems and human populations) should be targeted for mitigation work.

- Note: Global climate protection calls for explicit reduction of emissions of LAC and O_3 precursors into the atmosphere. Protecting the Arctic and water stored in the form of mountain glaciers and snow pack may be accomplished by diverting smoke away from these sensitive areas, similar to practices sometimes used to protect air quality and visibility.. However, atmospheric forcing due to biomass burning related LAC and O_3 can only be mitigated by emissions reductions.

- What seems possible:
    - Wildfires. There are opportunities to:
        - Reduce emissions via suppression
        - Reduce fuel loadings – harvesting these for biomass-based energy
        - Change management response, such as managing the fire phase to favor lower total LAC emissions (flaming vs. smoldering)
        - establish global (international) fire management structures capable of managing wildfires according to climate and human/ecosystem health priorities

    - Prescribed burning – There are opportunities to
        - Distinguish between smoke management practices used to protect air quality and visibility, and those that are needed for mitigating climate

pollutants. One of the primary goals in either situation could be to protect specific areas from smoke exposure smoke.

- Minimize, reduce or eliminate emissions from fire used for resource management purposes by changing how a fire is managed (thus affecting emissions),
- Establish alternative uses for biomass (thus less biomass available to burn), and/or change how the resource is managed (thus changing the kind of vegetation needing to burn), and or look for more alternatives to burning.
- Change the timing of burns to alter the extent or direction that smoke is transported.
    - To reduce emissions?
    - To alter the composition of emissions to minimize negative climate impacts?

- Agricultural
    - Biofuel development (using crop waste)
    - Crop switching
    - Technology changes, e.g.
        - No-till farming practices,
        - Use of residues for fertilization
        - Other no-burn options
    - Change timing (as in prescribed burning above)

- Design considerations:
    - Plans must be designed to fit the sources and regions. Situations vary widely.
    - Situations when burns are necessary for meeting other environmental needs must be recognized.
    - Wildland system dynamics must be factored into planning with regard to any natural wildfire mitigation strategies.
    - Need to consider the complete lifecycle impacts (costs) of available options, e.g. "multicriteria lifecycle analyses"
        - Cost of developing any necessary infrastructure
        - Costs associated with education and on-going promotion of the use of low emissions practices by farmers and land-managers, if any

        - Fuel and material expenditures to exercise alternative fuel management practices, such as diesel fuel used to remove biomass from woodlands and farms; to process it into marketable material, etc.
        - Impacts on ecosystems and land resources:
            - Changed resistance to diseases and pests
            - proliferation of undesirable or invasive species
            - Soil Compaction
            - Water Quality
            - Removal of Nutrients
            - Impacts on Wildlife Habitat
            - Threatened and Endangered Species
            - Impacts on Cultural Resources

        - Net GHG/SLCF and other air pollutant emissions for entire mitigation activity
        - Net economic impacts
        - Other unintended consequences

    - *Technical Considerations*
        - Desired Future Condition
        - Habitat Types
        - Fuel Category
        - Fuel Structure
        - Topography
        - Accessibility
        - Treatment Options

    - *Existing Conditions*
        - Historical Fire Regime
        - Condition Class

    - *Desired Future Condition*
        - Objective (resource protection or ecological restoration)
        - Legitimate reasons to burn (pests, mold, etc)
        - Structural objective

- BC/LAC emissions reduction approaches that might be worth exploring
    - If brown carbon produced by smoldering proves to be an important source of atmospheric absorption, can LAC emissions reductions be achieved by directly managing fire stages, e.g. only intentionally burn under conditions favoring the hot/flaming stages versus smoldering to reduce BrC emissions?
    - Continue efforts in global biofuel technology development, e.g. cellulosic

- Biochar – converting excess agricultural waste, and other excess biomass fuels into “biochar” as a means of carbon sequestration.

2. **How do the mitigation opportunities differ between world regions** for this sector, considering the range of available options?

Most existing emissions mitigation techniques we use domestically can be used internationally although there are regional differences in the appropriate use of some of them.

- The choice of technique will depend upon:
  - All of the same criteria as for the design of domestic emissions reduction policies, with added emphasis on:
    - Economic situation
    - Fire management capabilities (infrastructure)
      - Example: Agricultural fires are known to be left uncontrolled, leading to wildfires in some regions of the world. Close work with farmers would be needed to encourage better choices in the use of fire
      - Some regions of the world have little or no existing management capability
      - Where management structures exist, some areas fail or are unable to enforce fire control requirements

  - Dominant fire emissions sources for some regions:
    - Sugar Cane - S & C America
    - rice, wheat - Asia
    - forests - Tropics
    - Savannahs - Africa
    - boreal forests - Northern high latitudes

3. **What next steps – analyses, data, assessments, and summaries – represent the low hanging fruit for clarifying policy mitigation options?** Considering efficacy, impacts, and benefits of mitigation options.

- Domestically: An obvious source of information and guidance would be the repositories accumulated by the US regional air quality policy organizations that support states in designing and implementing smoke management programs. We can evaluate current best practices for emissions management for the potential for climate benefits

- Internationally: Until an inventory of the available information sources is done, it is difficult to say which, if any, have the ready, appropriate guidance needed.

- Requirements for better characterizing particular biomass burning sources for their climate polluting impacts and for identifying the most effective strategies for managing it, include:
    - Better understanding about the source-specific chemistry, transport and down-wind forcing effects of particular sources
    - Indentifying data that would improve global climate/AQ model estimates of forcing
    - More reliable worldwide emissions estimates built upon:
        - Better use of satellite observations
        - Better chemical speciation of emissions by source
        - Including optical properties with chemical speciation
        - Including uncertainty analysis on emission factors.
        - Adapting fuel consumption models to provide more climate-relevant emissions estimates.
        - Identifying fuel/carbon loading on land types, geographic distribution and acreage of these land types
        - Better information on prescribed burning methods – timing, locations, fuel conditions, etc.

4. **What immediate follow-ups to this workshop** would you suggest?

- A larger gathering of the right experts, policy designers and stakeholders is needed to discuss biomass emissions mitigation as a climate warming mitigation strategy.
    - Proposals (straw) should be developed – first, so something concrete can be productively assessed
    - Workshop participants identified
    - Make it transparent, but limit participation to those with the appropriate expertise and/or policy implementation experience

- Can an international, impact specific, e.g. Arctic, emissions reduction strategy team be convened in the short-term?
    - Quantify global harm associated with loss of Arctic, Himalayan, other ice pack.
    - Evaluate when it is necessary to fight wildfires or not to prevent Arctic deposition, and other criteria to improve feasibility of proposed strategies
    - Design necessary international infrastructure to mitigate emission
    - Is there any way to accelerate the implementation of the proposed emissions reduction program? (What legal structures already exist?)