



NCASI

2022 Resource Catalog

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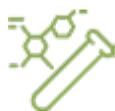
The research programs of the National Council for Air and Stream Improvement (NCASI) often result in the publication of Technical Bulletins, White Papers, and a variety of other publications, tools, and resources. In our 80 year history, NCASI has published more than 2,000 of these documents, representing a major contribution to the body of technical literature on environmental quality management and the forest products industry.

The following is a catalog of the resources we have published in 2022. These resources are available free of charge to Members who log in to the NCASI website, www.ncasi.org. Printed copies may also be obtained by sending a request to publications@ncasi.org.

Legend



Air Quality



Chemical
Management
& Health
Effects



Forest
Sustainability



Sustainability
& Climate



Water
Resources



Wood
Products



Technical Bulletins



Technical Bulletin No. 1077: Biotic Response to Mill Effluents in Whole Effluent Toxicity (WET) Tests: Comparison of Existing Methods with New Methods Under Development by EPA *(Published 3/22)*

EPA is exploring additional WET assessment methods and species to provide more options for addressing specific discharge permit objectives, including a short-term chronic test with another macroinvertebrate species, *Daphnia magna*, and an additional plant species (e.g., *Lemna gibba*). This NCASI study evaluated acute and chronic responses to seven US pulp and paper mill effluents in four test species (*C. dubia*, *D. magna*, *R. subcapitata*, and *L. gibba*) using promulgated methods and methods under EPA development to determine the relative sensitivity of the currently-used WET test species and those being considered for inclusion in the NPDES permit program.

Link: <https://www.ncasi.org/resource/biotic-response-to-mill-effluents-in-whole-effluent-toxicity-tests-comparison-of-existing-methods-with-new-methods-under-development-by-epa/>



Technical Bulletin No. 1078: An Overview of the Impact of Operating Conditions and Fuel Co-firing on Air Emissions from Bark Boilers *(Published 6/22)*

NCASI collective experience is summarized in this technical bulletin to provide the reader an overall understanding of the impacts of firing wood residues, either alone or in combination with various other fuels in FPI boilers. The report covers topics such as (1) the fate and role of unburned carbon in boiler fly ashes, (2) the fate and role of sulfur in combination boiler fuel mixes, (3) the fate and role of chlorine in boiler fuel, (4) the interplay between chlorine and sulfur in boiler fuel, (5) the fate of mercury in combination bark boiler fuels, (6) the fate of nitrogen in boiler fuel, (7) CO emissions minimization from bark boilers, (8) the emission impacts of burning WWTP residuals in bark boilers, (9) the emission impacts of burning various alternate fuels in bark boilers, (10) the prediction of trace metal emissions from bark boilers based on field particulate matter (PM) emissions measurement and trace metals concentrations in bark fuel, and (11) the differences in air emissions when burning bark in stokers versus fluidized beds.

Link: <https://www.ncasi.org/resource/technical-bulletin-no-1078-an-overview-of-the-impact-of-operating-conditions-and-fuel-co-firing-on-air-emissions-from-bark-boilers/>



Technical Bulletin No. 1079: Evaluation of US EPA Method 202 for Precursor Bias *(Published 11/22)*

Tightened ambient air quality standards for PM_{2.5} have created a challenging environment for manufacturing facilities. Facilities must demonstrate, through modeling, that their current and/or proposed operations will not adversely affect ambient levels of PM_{2.5} when engaged in PSD and/or new source review permitting activities. There is a dearth of high-quality PM_{2.5} emissions data on many source types. This lack of high-quality data could have negative economic consequences if the data used are biased high and result in modeled impacts that are greater than actual. NCASI carried out extensive field and laboratory evaluations of USEPA Method 202 to quantify systematic and precursor biases for multiple source conditions.

Link: <https://www.ncasi.org/resource/technical-bulletin-no-1079-evaluation-of-usepa-method-202-for-precursor-bias/>



Technical Bulletin No. 1080: Bioaccumulation Potential of PFAS in Fish *(Published 11/22)*

This review summarizes fish bioconcentration factors (BCFs) and bioaccumulation factors (BAFs) from high-quality research identified in an extensive literature review by Burkhard (2021), and focuses primarily on BAFs and BCFs generated using fish muscle tissue, which is appropriate when consumption of fish filets is the primary exposure pathway. The studies reviewed demonstrate that the bioaccumulation potential of PFAS is highly variable and strongly associated with chemical structure (i.e., functional group, carbon chain length), and that PFAS BAFs and BCFs can vary widely across and within species. A table summarizing the bioaccumulation potential of PFAS in various species of fish is included.

Link: <https://www.ncasi.org/resource/technical-bulletin-no-1080-bioaccumulation-potential-of-pfas-in-fish/>

White Papers



White Paper No. 22-01: Scenario-Based Climate Change Risk Assessment under TCFD and CDP (Published 1/22)

This white paper provides an overview of the requirements of the TCFD and CDP programs, and suggests resources useful in conducting scenario analyses under these and other programs. To enhance stakeholder acceptance of scenario analyses performed by North American companies, this paper relies primarily on information and tools from TCFD, CDP, the Intergovernmental Panel on Climate Change (IPCC) and the governments of the US and Canada.

Link: <https://www.ncasi.org/resource/scenario-based-climate-change-risk-assessment-under-tcfd-and-cdp/>



White Paper No. 22-02: Summary of Health Effects Research for Per- and Polyfluoroalkyl Substances (Published 6/22)

This white paper reviews the state of the science regarding the potential health effects of several PFAS that are of interest to state and federal regulatory agencies. Despite being considered chemically similar and often grouped as a class of chemicals, individual PFAS possess unique biochemical properties. This is reflected in the variety of health impacts associated with specific PFAS, as well as a substantial range of doses at which these health effects may occur. The science in this area is rapidly developing and evolving; the toxicity factors and the relevant studies are current to date, but may soon be outdated. This document will be updated as needed to reflect the current state of the regulatory science.

Link: <https://www.ncasi.org/resource/summary-of-health-effects-research-for-per-and-polyfluoroalkyl-substances-pfas/>



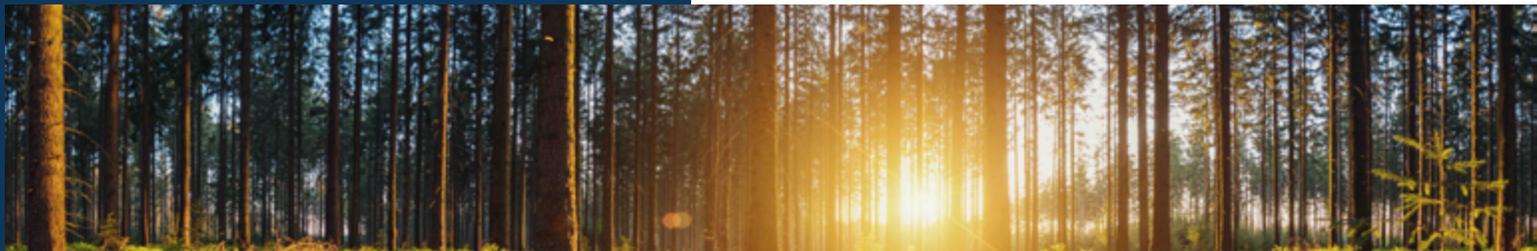
White Paper No. 22-03: An Overview of Reduced Sulphur Emissions from Kraft Pulp Mills (Published 7/22)

This white paper discusses the most relevant environmental and health aspects associated with the emission of reduced sulphur compounds (RSCs) from kraft pulp mills. The overview starts by summarizing relevant properties of the four major RSCs emitted from kraft pulp mills, their natural and anthropogenic sources, environmental fate, and odour threshold ranges. It also addresses the formation of RSCs within pulping and chemical recovery processes, as well as the control and reduction of RSC emissions. This is followed by a discussion about wastewater treatment systems receiving untreated loads of RSCs and the effect of condensate management, wastewater treatment operations, and targeted chemical treatment options on reducing fugitive RSC emissions. Discussions on odour management and legislation, and on measurement methods, are also included.

Link: <https://www.ncasi.org/resource/an-overview-of-reduced-sulphur-emissions-from-kraft-pulp-mills/>



Briefing Notes



BN-22-01: Updates to the Forest Inventory and Analysis Database *(Published 7/22)*

In July/August 2022, a major update to the US Forest Service's Forest Inventory and Analysis (FIA) database will include new tree biomass equations, new tree carbon factors, and new estimation methods for carbon in the forest litter and soil carbon pools. As the new equations and models are incorporated into the FIA database, estimates of live tree carbon will increase an average of 11%, estimates of carbon in the forest litter layer will decrease by approximately 31%, and estimates of forest soil carbon will increase by up to 75%. Combined, the changes may lead to an increase in estimates of forest ecosystem carbon in the US by about a third. These changes will likely affect carbon footprint analyses for NCASI Member Companies that rely in part on conversion factors, carbon stock and flux estimates, or published data from the FIA programs.

Link: <https://www.ncasi.org/resource/updates-to-the-forest-inventory-and-analysis-database/>



BN-22-02: Trends in Forest Harvest, Regeneration, and Management in the Southeastern United States as Related to Biomass Feedstock *(Published 8/22)*

Woody biomass has received substantial attention as a renewable energy source and, thus, is at the forefront of climate change mitigation policies to help reduce greenhouse gas (GHG) emissions. Wood-based biomass feedstock production in the United States (US) has tripled over the last decade, largely due to European commitments to reduce GHG emissions and reliance on fossil fuels (Masum et al. 2019; Giuntoli et al. 2022). This trajectory is expected to continue as international demand increases, particularly for biomass feedstocks used for power and heat generation, or for industrial applications and other hard-to-abate sectors (i.e., wood for pellets and energy production). Guo et al. (2015) estimated that bioenergy will comprise 30% of the global energy consumption by 2050. There are concerns that increased demand for wood-based bioenergy may lead to forest and biodiversity loss through either increased levels of planted stands and/or harvesting, particularly in the southeastern US, which is a key region for wood pellet production (Olesen et al. 2016; Giuntoli et al. 2022). To better understand potential effects of bioenergy demand on forest resources, NCASI evaluated harvest and regeneration trends and drivers of forest management across the southeastern US as related to potential forest loss.

Link: <https://www.ncasi.org/resource/trends-in-forest-harvest-regeneration-and-management-in-the-southeastern-united-states-as-related-to-biomass-feedstock/>



BN-22-03: Biodiversity and Biomass Feedstock in the Southeastern US *(Published 8/22)*

Some forest stakeholders have expressed concern about biodiversity responses to harvesting for biomass feedstock, use of hardwoods for biomass feedstock, and overall sustainability of forest stands where at least part of the harvested biomass is used for biomass feedstock. Biodiversity in managed forests is relatively well-studied, including biodiversity responses to specific components of forest management, such as site preparation and planting, thinning, and final harvest (for even-aged management). This briefing note examines how harvesting for biomass feedstock relates to forest harvesting and identifies current knowledge gaps concerning biodiversity response to this harvesting.

Link: <https://www.ncasi.org/resource/biodiversity-and-biomass-feedstock-in-the-southeastern-us/>



Handbooks



Handbook of Chemical-Specific Information for SARA Section 313 Form R Reporting *(updated 4/22)*

The NCASI Handbook of Chemical-Specific Information for SARA Section 313 Form R Reporting (SARA Handbook) is maintained to assist Member Company personnel with responsibility for preparing SARA Section 313 Form R reports, which are due annually on July 1. It includes summaries of applicable EPA regulations, relevant NCASI Corporate Correspondent Memoranda, and chemical-specific information sheets for compounds that may be subject to Section 313 reporting requirements at pulp and paper mills, wood products facilities, and recycling and non-integrated mills.

Link: <https://www.ncasi.org/resource/handbook-of-chemical-specific-information-for-sara-section-313-form-r-reporting/>

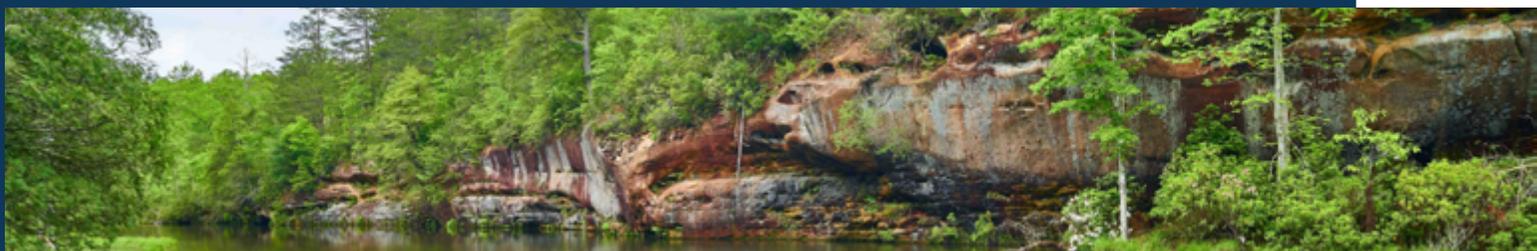


NCASI Support Document on NPDES Permitting *(Published 10/22)*

This NCASI support document is intended to assist NCASI Members with the NPDES permit renewal process by providing information that may be useful during the time an agency is reviewing and updating permit conditions. The document is organized around common questions NCASI has received from its Members when applying for NPDES permit renewals and/or responding to draft permits issued by regulatory agencies. Information provided to address these matters focuses on opportunities for improving permit conditions to both enhance prospects for complying with the permit and, in some cases, to reduce permit-related costs.

Link: <https://www.ncasi.org/resource/ncasi-support-document-on-npdes-permitting/>

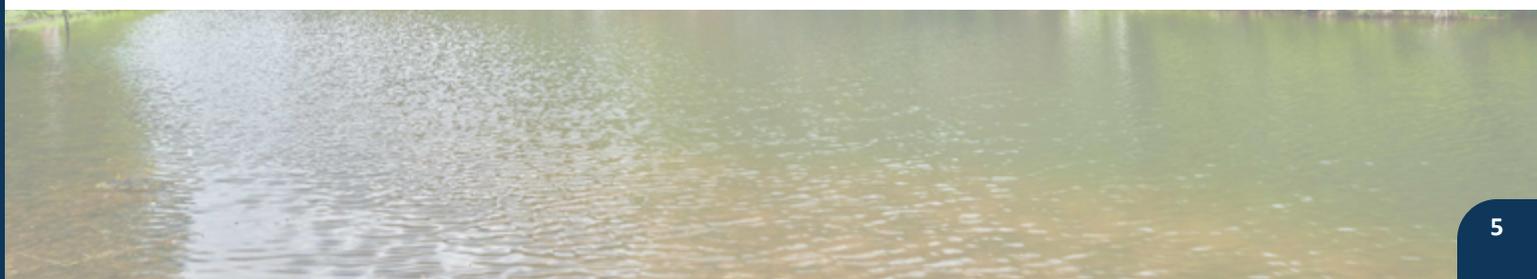
Corporate Correspondent Memoranda



CC-22-001: Proposed Rule to Revise the Definition of “Waters of the United States” *(Published 2/22)*

On December 7, 2021, the Environmental Protection Agency and the Department of the Army Corps of Engineers released a “Revised Definition of Waters of the United States,” a revision of the 2020 Navigable Waters Protection Rule (NWPR) defining the scope of waters federally regulated under the Clean Water Act (CWA). This memorandum provides a summary of past rules defining “Waters of the United States” and the 2021 Proposed Rule. The technical comments that NCASI submitted to EPA on February 7, 2022, are provided as an attachment.

Link: <https://www.ncasi.org/resource/cc-22-001-proposed-rule-to-revise-the-definition-of-waters-of-the-united-states/>





CC-22-002: Sector-Specific Fact Sheets in EPA Multi-Sector General Permit for Industrial Stormwater – Request for Public Input *(Published 2/22)*

In the January 25 issue of the *Federal Register*, EPA made notice of its request for comments on the sector-specific fact sheets associated with the Multi-Sector General Permit (MSGP) for industrial stormwater. In EPA's draft 2021 MSGP (see Corporate Correspondent Memorandum No. 21-004), EPA had proposed to incorporate a portion of the fact sheets into the MSGP as sector-specific Stormwater Control Measure (SCM) checklists. Ultimately, EPA chose not to do so, but did make clear its intent to consider updating the fact sheets and potentially using them for identifying SCMs in a future MSGP. This notice indicates EPA's plans to follow through on that intent.

Link: <https://www.ncasi.org/resource/cc-22-002-sector-specific-fact-sheets-in-epa-multi-sector-general-permit-for-industrial-stormwater-request-for-public-input/>



CC-22-003: Proposed Rule – Clean Water Act Hazardous Substance Worst Case Discharge Planning Regulations *(Published 3/22)*

The March 28 issue of the *Federal Register* [FR 87 (59) 17890-17935] contained a proposed rule to require the development of Facility Response Plans (FRPs) for worst case scenario discharges of Clean Water Act (CWA) hazardous substances for facilities that could cause substantial harm by discharging into navigable waters. The proposal is predicated on long-standing requirements of the Clean Water Act for which EPA has yet to take formal action. The rule, as proposed, would apply to facilities located within one-half mile of a navigable water (or drainage connected to a navigable water) and who have the capacity to store any of the nearly 296 CWA hazardous substances in a quantity greater than 10,000 times the Reportable Quantity (RQ).

Facilities meeting these conditions would have to develop an FRP if any of four “substantial harm criteria” are met. These criteria include the ability to adversely impact a public water system; the ability to cause injury to fish, wildlife, and sensitive environments; the ability to cause injury to public receptors; and/or having had a reportable discharge of a CWA hazardous substance within the last five years. If these criteria are met, an FRP would be developed that includes some 18 identified components. The proposed rule will be of interest to all companies that have onsite chemical storage.

Link: <https://www.ncasi.org/resource/cc-22-003-proposed-rule-clean-water-act-hazardous-substance-worst-case-discharge-planning-regulations/>



CC-22-004: EPA - Water - Draft PFOA and PFOS National Water Quality Recommendations *(Published 5/22)*

On April 29, 2022, EPA released information related to managing PFAS in wastewaters and receiving waters. The information focused on three topics: (1) draft aquatic life water quality criteria for PFOA and PFOS in freshwaters, (2) PFAS provisions to be included in EPA-issued NPDES permits, and (3) a draft method (EPA Method 1621) for adsorbable organic fluorine in wastewater. The NPDES permit provisions for PFAS are applicable only in states where EPA issues permits, though EPA did indicate that guidance for state-issued NPDES permits would be forthcoming. NCASI is not currently planning to comment on the draft water quality criteria. Summaries detailing important aspects of the three topics announced by EPA are provided in this memorandum.

Link: <https://www.ncasi.org/resource/cc-22-04-epa-water-draft-pfoa-and-pfos-national-water-quality-recommendations/>



CC-22-005: EPA - New and Updated Health Advisories for Four PFAS *(Published 6/22)*

On June 15, 2022, EPA published updated drinking water Health Advisories (HAs) for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) that replace those EPA issued in 2016. New HAs have also been published for perfluorobutane sulfonic acid and its potassium salt (PFBS) and for hexafluoropropylene oxide (HFPO) dimer acid and its ammonium salt (“GenX chemicals”). These are available on the EPA Drinking Water Health Advisories webpage. The updated HAs for PFOA and PFOS are based on toxicity values (RfDs) that are 4-5 orders of magnitude less than the previously relied upon values, resulting in HAs that are lower by 4-5 orders of magnitude than the previous combined HA of 70 ppt. Summaries detailing the updated HAs are provided in this memorandum.

Link: <https://www.ncasi.org/resource/cc-22-005-epa-new-and-updated-health-advisories-for-four-pfas/>



CC-22-006: Request for Most Recent Form 2C Application and NPDES Permits *(Published 8/22)*

NCASI's current Technical Studies Program includes a task to update a database containing Form 2C and NPDES permit information for mills (Task 23.WR.CE.4). As part of this task, NCASI Water Resources staff are soliciting copies of mills' most recent Form 2C applications and NPDES permits. Facilities possessing these documents are asked to consider providing them to Camille Flinders, Senior Program Manager. This request pertains to pulp and paper mills with NPDES permits for the direct discharge of treated wastewater.

Link: <https://www.ncasi.org/resource/cc-22-006-request-for-most-recent-form-2c-application-and-npdes-permits/>



CC-22-007: EPA Proposal to Designate PFOA/PFOS under CERCLA *(Published 9/22)*

On August 25, 2022, EPA issued a proposal to designate perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or “Superfund.” The proposal applies to PFOA/PFOS, including their salts and structural isomers. EPA is expected to publish the Notice of Proposed Rulemaking in the Federal Register in the next several weeks. Upon publication, a 60-day comment period will commence.

This information will be of interest to all mills. Designation of PFOS and PFOA as CERCLA “hazardous substances” has numerous potential implications for the pulp and paper industry, which are noted and discussed in this memorandum.

Link: <https://www.ncasi.org/resource/cc-22-007-epa-proposal-to-designate-pfoa-pfos-under-cercla/>



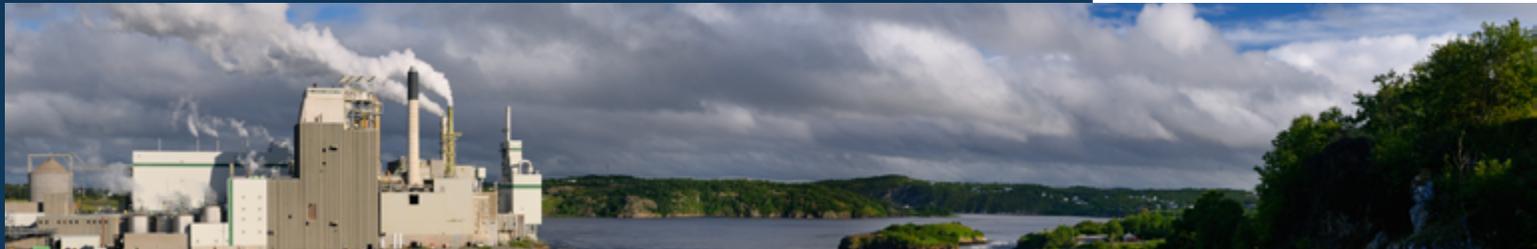
CC-22-008: EPA - Proposed Federal Implementation Plan (FIP) Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standard (NAAQS) - NCASI Comments *(Published 9/22)*

NCASI filed technical comments on the recent EPA proposal to implement Federal Implementation Plan (FIP) requirements for 26 upwind states, to reduce emissions of ozone precursors that are stated to impact attainment and maintenance with the 2015 National Ambient Air Quality Standard (NAAQS) for ozone in downwind states. The proposed rule was published in the Federal Register on April 6, 2022. EPA also issued a fact sheet that provides high level summaries of the various provisions of the rule. The EPA fact sheet and NCASI’s technical comments are attached to this memorandum.

This information will be of interest to all manufacturing facilities located in the following upwind states: Alabama, Arkansas, California, Colorado, Delaware, Indiana, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nevada, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, Utah, Virginia, Wisconsin, and West Virginia.

Link: <https://www.ncasi.org/resource/cc-22-008-epa-%e2%80%90-proposed-federal-implementation-plan-fip-addressing-regional-ozone-transport-for-the-2015-ozone-national-ambient-air-quality-standard-naaqs-%e2%80%90-ncasi-comments/>

Strategic Information Memoranda

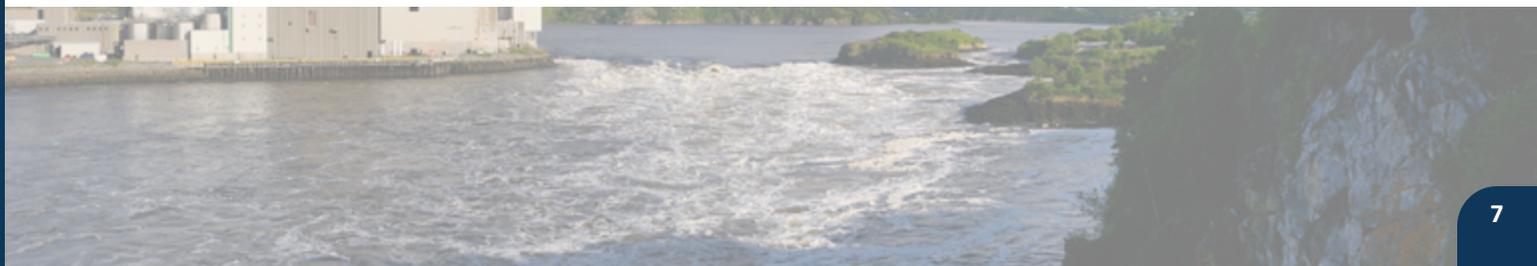


SIM-22-001: *Canada Gazette* Notice with Respect to Reporting of Greenhouse Gases (GHGs) for 2021 *(Published 5/22)*

Environment and Climate Change Canada (ECCC) provides annual notice of requirements for reporting the previous year’s greenhouse gas emissions. Notice regarding “Reporting of greenhouse gases (GHGs) for 2021” was published in the December 18, 2021, *Canada Gazette*. This Strategic Information Memorandum is being released as a reminder for facilities that are required to report this information by June 1, 2022. This information is relevant to all Canadian forest products manufacturing facilities.

The *Gazette* Notice details the requirements for reporting estimated 2021 GHG releases to the Minister of the Environment and Climate Change. This is a continuation of the mandatory GHG reporting program, which began with the reporting of 2004 GHG releases.

Link: <https://www.ncasi.org/resource/sim-22-001-canada-gazette-notice-with-respect-to-reporting-of-greenhouse-gases-ghgs-for-2021/>





SIM-22-002: *Canada Gazette* Notice with Respect to Substances in the National Pollutant Release Inventory (NPRI) for 2022, 2023, and 2024 *(Published 6/22)*

On February 12, 2022, Environment and Climate Change Canada (ECCC) published in the *Canada Gazette* requirements for regulatory reporting under the National Pollutant Release Inventory (NPRI) for 2022, 2023, and 2024. This information is relevant to all Canadian forest products manufacturing facilities.

ECCC has announced that several changes have been made to the reporting requirements for 2022, 2023, and 2024 calendar years. Facilities should report their releases for the 2022 calendar year no later than June 1, 2023; for the 2023 calendar year no later than June 3, 2024; and for the 2024 calendar year no later than June 2, 2025. The changes made to the reporting requirements that are relevant to forest products manufacturing facilities are summarized in this memorandum.

Link: <https://www.ncasi.org/resource/sim-22-002-canada-gazette-notice-with-respect-to-substances-in-the-national-pollutant-release-inventory-npri-for-2022-2023-and-2024/>

Review and Response



Literature Summaries on Contaminants in Food Contact Materials *(Published 6/22)*

NCASI staff periodically review the published scientific literature addressing issues related to the presence of contaminants in food contact materials manufactured from wood pulp.

Reviewed publications address issues related to:

- Effectiveness of barrier materials for preventing migration of contaminants into food or food simulants
- Development of methods to identify and quantify chemicals in food contact materials or food/food simulants
- Identifying and quantifying specific chemicals/chemical classes in FCM or food/food simulants

Link: <https://www.ncasi.org/resource/contaminants-in-food-contact-materials/>

Fact Sheets



FS-22-01: Assessing the Impacts of Fire on Forests *(Published 1/22)*

Fire can have positive or negative effects on forest ecosystems, depending on the characteristics of the forest and of the fire. The results of the interaction between fire, weather, and forests are often described using the terms fire severity and fire intensity. These terms are often used together, but have different meanings. This fact sheet presents the common measures of fire severity and fire intensity, and the importance of understanding these measures.

Link: <https://www.ncasi.org/resource/assessing-the-impacts-of-fire-on-forests/>



FS-22-02: Finding Enough Good Food to Eat Can be Challenging for Caribou in Northeastern British Columbia *(Published 2/22)*

Many methods exist to estimate forage quantity and quality of plant communities for ungulates, but most lack information on relationships between forage characteristics and levels of nutrition obtained by foraging animals. NCASI's research uses bottle-raised tame caribou that allow for accurate measurements of bite mass, bite rate, foraging time, and species and parts of plants consumed, all of which are used to directly measure the nutritional value of plant communities to caribou.

Link: <https://www.ncasi.org/resource/finding-good-food-to-eat-can-be-challenging-for-caribou-in-northeastern-british-columbia/>



FS-22-03: Forest Harvest Effects on Low Flow *(Published 3/22)*

Seasonal low flow is critical for human water supply during prolonged dry periods, and is important for aquatic biota and riparian vegetation. In some regions, such as the Pacific Northwest, this dry period coincides with the growing season when evapotranspiration rates are elevated. Understanding the influence of forest management on seasonal low flow is increasingly important with a changing climate.

This fact sheet addresses several questions:

- What effect will climate change have on surface waters?
- How does forest succession affect seasonal low streamflow?
- Which factors affect variable low flow responses?
- How may long-term climate trends interact with forest management?
- Do low flow responses persist downstream?
- Are aquatic organisms affected by long-term low flow declines?
- Will overstory thinning alleviate seasonal low flow declines?
- How may riparian buffers affect low flow responses?

Link: <https://www.ncasi.org/resource/forest-harvest-effects-on-low-flow/>



FS-22-04: Fecal Indicator Bacteria *(Published 4/22)*

Fecal indicator bacteria (FIB) assays are used as surrogate measures of the sanitary quality of surface waters and industrial discharges. Most states have recreational water quality criteria (RWQC) that specify limits for FIB, with total coliform, fecal coliform, *Escherichia coli* (*E. coli*), and enterococci classified as FIB. Limits vary depending on the designated use of the water body, time of year, and other local factors. To ensure that treated pulp and paper mill effluents do not pose a risk to human health and to protect recreational use (e.g., swimming, fishing, boating) in receiving waters, National Pollutant Discharge Elimination System (NPDES) permits may include limits or monitoring requirements for FIB. NPDES permits specify the FIB endpoint to be measured, the frequency and timing of testing (e.g., year-round or seasonal monitoring), and the acceptable analytical test methods. This fact sheet provides an overview of the analytical methods commonly used to test for FIB in pulp and paper mill effluents and implications for the industry.

Link: <https://www.ncasi.org/resource/fecal-indicator-bacteria/>



FS-22-05: NOAA State Climate Summaries *(Published 5/22)*

The National Oceanic and Atmospheric Administration (NOAA) has created State Climate Summaries of observed and projected climate change. This fact sheet documents the climate variables covered on their website, model projection summaries, and limitations of models and data. The climate summaries may be useful to forest products companies as they work to understand the potential effects of climate on current and future operations, and to contextualize local climate conditions for various reporting purposes, such as Environment, Sustainability, and Governance (ESG) disclosures.

Link: <https://www.ncasi.org/resource/noaa-state-climate-summaries/>





FS-22-06: Invasive Species in US Forests: Risks and Information Needs *(Published 5/22)*

Invasive species are non-native organisms that can cause significant negative economic and/or ecological effects across large landscapes. Invasive plants can reduce forest productivity, inhibit regeneration, and increase fire risk; invasive insects and pathogens can damage and kill trees. Over the past 200 years, hundreds of invasive species have become established in the United States, with estimated damages exceeding \$150 million per year in the forest sector. Previous invasions have functionally eliminated a keystone species in eastern North American forests, the American chestnut (*Castanea dentata*), and currently threaten to eliminate ash (*Fraxinus spp.*), red bay (*Persea borbonia*), eastern hemlock (*Tsuga canadensis*), and other tree species. The rate of spread of invasive species has increased over the past several decades due to growth in international trade and transportation.

This fact sheet provides a brief overview of the risks to commercial forestry posed by invasive species, and the current research gaps associated with cost-effective solutions.

Link: <https://www.ncasi.org/resource/invasive-species-in-us-forests-risks-and-information-needs/>



FS-22-07: Forest Management and the Water Cycle *(Published 8/22)*

More than 15% of the world's forest acreage is found in the United States and Canada. Trillions of gallons of water originate in forested acres that are used by society and the forest products sector. From an environmental services viewpoint, forests act as reservoirs that store and release water through their influence on and interaction with hydrological processes. As stewards of drinking water source areas, it is important for forest owners and managers to understand how forest management affects water quantity and timing of delivery, particularly in the context of climate change.

This fact sheet examines the complex relationship between forest management, climate, and water. Coupled with sustainable forest management practices that include using regulated forest practices or forestry best management practices (BMPs), forests help provide a stable, predictable, and high-quality water supply.

Link: <https://www.ncasi.org/resource/forest-management-and-the-water-cycle/>



FS-22-08: Wood Ash as a Soil Amendment *(Published 11/22)*

Forest products manufacturing facilities generate large amounts of boiler ash from burning woody biomass. Most of this ash ends up in landfills and wastewater lagoons. This situation represents a relatively untapped opportunity to recycle a mill residual into a valuable soil amendment, replace commercial fertilizers and lime, reduce landfill disposal costs and, in some cases, add a source of revenue for mills.

This fact sheet provides an overview of wood ash characteristics and the types of wood ash generated at forest products facilities, examining the benefits and challenges of application to agricultural lands and forest lands.

Link: <https://www.ncasi.org/resource/wood-ash-as-a-soil-amendment-fs-22-08/>



FS-22-09: Soil Carbon and Forest Management - Focus on the Great Lakes Region

(Published 12/22)

Soil is the foundation of forest ecosystems, and soil organic matter, which is mostly carbon, supports many ecosystem functions. As carbon accounting and monitoring have become important parts of reporting initiatives and sustainability practices, forest stakeholders are increasingly focused on soils, both because of their carbon storage and because they support forests' capacity to adapt to climate change and recover from disturbances.

This fact sheet provides an overview of soil organic matter in forests and how various forest management practices affect soil carbon. It examines soil carbon issues specific to the forest products industry in the Great Lakes region, and suggests guidelines for protecting carbon in the soil during harvesting.

Link: <https://www.ncasi.org/resource/soil-carbon-and-forest-management-focus-on-the-great-lakes-region-fs-22-09/>





FS-22-10: Climate Change and Historical Forest Growth Changes in the US and Canada

(Published 12/22)

The forest products sector depends on predictable tree growth to ensure the supply of raw materials. Factors associated with climate change, such as rising levels of carbon dioxide (CO₂), a prolonged growing season, and changes in temperature, precipitation, and natural disturbance regimes (duration, intensity, and frequency), are already changing the growth rate of trees, which can alter wood properties and harvest rotation ages. Furthermore, how these factors interact will vary by species and region, and will change over time. This fact sheet provides a brief overview of current knowledge about historical changes in forest growth and suggests how continuing changes may impact future fiber supply.

Link: <https://www.ncasi.org/resource/climate-change-and-historical-forest-growth-changes-in-the-us-and-canada-fs-22-10/>

Chemicals in Products Sheets



Bisphenol Compounds *(Published 6/22)*

Bisphenol compounds are a group of organic chemicals with two hydroxyphenyl functionalities. There are a number of bisphenol analogues, and they are named based on one of their reactants. Bisphenol A (BPA) is one of the most common bisphenol compounds, and it is formed from a reaction of phenol and acetone. BPA carries the "A" designation based on the acetone reactant. Other common analogues of BPA include Bisphenol S (BPS) and Bisphenol F (BPF). BPA is an industrial chemical used for the manufacture of plastics and as a starting material for the production of epoxy resins. BPA has also been used in thermal papers, paper currencies, and printing inks.

BPA and its analogues can be a component of the secondary, or recycled, fiber supply. Based on the studies reviewed, the data generally showed higher concentrations of BPA and its analogues in recycled paper and cardboard products when compared to virgin products. However, the measured concentrations in paper and in food products generally do not exceed established regulatory limits, thus suggesting that current uses of BPA are not expected to result in exposures that pose a health risk.

Link: <https://www.ncasi.org/resource/bisphenol-a-in-products/>



Infographics



Mapping the Environmental, Social, and Governance Landscape *(Published 10/22)*

Evaluating a company's performance in Environmental, Social, and Governance (ESG) has evolved as an approach for the financial community to determine the potential impact these three areas may have on an investment. ESG focuses on off-balance sheet risks.

NCASI has mapped the landscape of ESG as it relates to environmental aspects relevant to the forest products industry. This interactive document includes embedded hyperlinks to online material and provides an overview of the five layers of the ESG landscape—risks, frameworks, organizations, methods, and ratings.

Link: <https://www.ncasi.org/resource/mapping-the-environmental-social-and-governance-esg-landscape/>



Forest management practices that enhance value of southeastern managed pine landscapes to bird communities *(Published 11/22)*

The southeastern US is widely known as a bastion of privately-owned, managed pine (*Pinus* spp.) forests, comprised primarily of native pine species. The region supports high levels of biodiversity, but also a multi-billion-dollar forest products economy critical to socioeconomic stability of rural areas.

NCASI participated in a systematic review of studies focused exclusively on avifaunal associations within privately-owned, managed pine landscapes in the southeastern US, which resulted in the publication of a peer-reviewed article in the journal *Forests*. The authors concluded that, overall, it appears that avian communities can be best maintained by providing a diverse mosaic of forest conditions in managed pine landscapes. Based on these findings, NCASI prepared this infographic to illustrate forest management practices that enhance value of southeastern managed pine landscapes to bird communities, highlighting bird species found in forest stands that are recently harvested, regenerating, intermediate aged, and mature.

Link: <https://www.ncasi.org/resource/forest-management-practices-that-enhance-value-of-southeastern-managed-pine-landscapes-to-bird-communities/>



Tools



Climate Projection Analysis Tool (CPAT) *(Published 2/22)*

NCASI developed the Climate Projection Analysis Tool (CPAT) to enable organizations to summarize climate projections for locations of interest in the conterminous United States. The tool is based on current (and recent past) climate measurements from the PRISM dataset (covering 1980 to 2019, interpolated from weather station data), and downscaled climate projections from the Coupled Model Intercomparison Project (CMIP-5).

Link: <https://www.ncasi.org/resource/cpat/>



GHG Calculation Tools for Wood Products Facilities *(updated 3/22)*

With financial support from AF&PA and FPAC, and considerable assistance from a working group of wood products experts from FPAC, AF&PA, and NCASI member companies, NCASI completed development of a calculation tool for GHG emissions from wood product manufacturing facilities in 2004. The International Version of the tools have been updated in 2022 to reflect updated Global Warming Potentials.

The calculation tool consists of two parts: 1) a report (PDF) that describes the approaches for estimating greenhouse gas emissions from wood products facilities, and 2) an Excel spreadsheet to aid in the calculations.

Link: <https://www.ncasi.org/resource/ghg-calculation-tools-for-wood-products-facilities/>



Summary of Best Available Technology for Controlling Criteria Air Contaminants *(Published 4/22)*

This workbook summarizes currently available technology for controlling criteria air contaminant emissions from the forest products industry. It consists of four tabs allowing the search of relevant information by specific criteria air contaminants (CACs), forest products industry sources, and emission control technologies. The 'Nature of Substances' tab shows information on the significance, and general principles behind the formation, of relevant CACs. The 'Process Sources' tab provides information on the formation of CACs from specific forest products industry sources. The 'Industrial Emission Control' tab shows what and how technologies have been implemented in the forest products industry to control CAC emissions from specific sources. Finally, the 'Emission Control Principles' tab offers a comprehensive view of relevant CAC emission control technologies, the principles upon which they are based, their performance, and their main advantages and disadvantages.

Link: <https://www.ncasi.org/resource/summary-of-best-available-technology-for-controlling-criteria-air-contaminants/>



Climate Change Glossary - Simplified Terminology for the Forest Products Industry *(Published 4/22)*

This page lists nearly 100 terms that appear frequently in news and journal articles on the topic of climate change. The definitions provided are simple and straightforward, and, where possible, highlight a term's specific relevance to the forest products industry. While these definitions have been simplified, NCASI staff are able to provide more detailed explanation upon request. For some terms, the definition is followed by a reference link to specific organizational, technical, and/or published definitions.

Link: <https://www.ncasi.org/resource/climate-change-glossary/>





Habitat Conservation Plans (HCPs) and Other State-level Forest Management Recommendations for Bats *(Published 12/22)*

NCASI prepared this spreadsheet to summarize bat HCPs and other state-level forest management recommendations available for 21 states (or regions) in the US. Although focused primarily on state-owned lands, the HCPs and other guidance documents may also be useful for providing recommendations for private forest landowners in those states/regions, especially for meeting forest certification expectations. The summary examines HCP and other state-level recommendations as they relate to buffers, fire restrictions, harvest restrictions, creation and protection of snags, road building, and corridors.

Link: <https://www.ncasi.org/resource/habitat-conservation-plans-hcps-and-other-state-level-forest-management-recommendations-for-bats/>

Videos



Wastewater Treatment Training Video Series, Vol. 5: AST Troubleshooting *(Published 11/22)*

This video training series, which is a part of NCASI's Technical Studies and Support Program, is intended to provide concise informational summaries of relevant wastewater topics to Members involved in the design, evaluation, and daily operation of Forest Product Industry wastewater treatment facilities.

Link: <https://www.ncasi.org/resource/wastewater-treatment-training-video-series/>

Webinars



NCASI Technical Program Activity Update - Sustainable Manufacturing & Climate *(Presented 1/22)*

This webinar provided an update on recent activities in the Sustainable Manufacturing & Climate Programs, including a five-year retrospective featuring the accomplishments of the program, as well as an overview of current program highlights and NCASI's strategy for SM&C for the next five years.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-sustainable-manufacturing-climate-jan2022/>





NCASI Technical Program Activity Update - Forestry - CPAT Demo *(Presented 2/22)*

NCASI's monthly Technical Program Activity Update Series continued in February with a webinar focused on the Forest Environment & Sustainability Program. During this webinar, Dr. Steve Prisley demonstrated the NCASI-developed Climate Projection Analysis Tool (CPAT). This tool, available to Member Companies, allows extraction of climate projections and baseline conditions for a location of interest in the continental US. The primary data available are climate data (annual projections to 2099, tables of temperature and precipitation, and graphs of monthly temperature and precipitation) and data on tree species distributions (current and projected).

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-forestry-feb2022/>



Canadian Forestry Research and Engagement Session on Old-Growth *(Presented 2/22)*

This webinar was hosted by Dr. Kevin Solarik (NCASI), with presentations by Dr. Kari Stuart-Smith (Manager, Biodiversity and Wildlife, Canadian Forest Products Ltd.) and Cam Brown (Resource Analysis, Forsite Consultants); Dr. Maxence Martin (Postdoctoral Researcher, UQAT/UQAC); Dr. David Andison (fRI Research, Healthy Landscapes, Program Lead); Dr. Ronnie Drever (Senior Conservation Scientist, Nature United); and Garry Merkle (Co-Chair, BC Old Growth Strategic Review Panel). Topics covered include Defining and Identifying Old-Growth, Managing Old-Growth Forests, and Non-Timber Values of Old-Growth Forests. The webinar concluded with a presenter roundtable during which questions from the audience were answered.

Link: <https://www.ncasi.org/events/forestry-research-and-engagement-session-on-old-growth/>



NCASI Technical Program Activity Update - Water Resources *(Presented 3/22)*

NCASI's Technical Program Activity Update in March provided an overview of recent activities in the Water Resources Program. Presentations covered the following topics:

- Water Resources Technical Studies and Support Program planned for the coming year.
- Significance of state regulatory actions related to fecal indicator bacteria from non-human sources and PFAS criteria for ambient waters.
- PFAS toxicity factors and the origin of EPA's recently proposed factors for drinking water.
- Discussion of select, recent NCASI support on wastewater treatment topics.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-water-resources-mar2022/>



NCASI Technical Program Activity Update - Air *(Presented 4/22)*

NCASI's monthly Technical Program Activity Update on April 5 focused on recent activities in the Air Program. The session included a discussion of projects in the FY23 program year (April 2022 – March 2023), specifically on understanding the ambient impacts of source emissions and plans to develop this emerging focus area. Technical summaries and key findings on topics related to combustion sources (e.g., impacts of TDF burning on mercury emissions, impacts of fuel co-firing on bark boiler emissions, NOx and mercury controls) were also presented.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-air-apr2022/>



SARA 313 Form R Reporting for 2021 – Wood Products and Pulp & Paper *(Presented 4/22)*

NCASI hosted two webinars (Wood Products and Pulp & Paper) on SARA Section 313 Form R Reporting in April 2022. These annual workshops serve as reviews of SARA reporting for each industry sector, and are intended for corporate and mill personnel with responsibility for preparing SARA Section 313 Form Rs, which are due on July 1.

Wood Products Webinar Link: <https://www.ncasi.org/events/sara-313-form-r-reporting-for-2021-wood-products/>

Pulp and Paper Webinar Link: <https://www.ncasi.org/events/sara-313-form-r-reporting-for-2021-pulp-and-paper/>





NCASI Technical Program Activity Update - Sustainable Manufacturing & Climate *(Presented 5/22)*

This Sustainable Manufacturing and Climate (SM&C) program activity update provided an overview of NCASI's recently published white paper on Scenario-Based Climate Change Risk Assessment under TCFD and CDP. TCFD and CDP, and similar programs, require companies to consider, under various scenarios, how they might be impacted by policies and environmental conditions associated with climate change. The white paper provides an overview of the requirements of the TCFD and CDP programs and suggests resources useful in conducting scenario analyses under these and other programs.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-sustainable-manufacturing-climate-may2022/>



Technical Discussion on the 2022 CSAPR "Good Neighbor" Proposal *(Presented 5/22)*

This webinar addressed EPA's recent Cross State Air Pollution Rule (CSAPR) proposal, of interest to all companies with pulp and paper manufacturing facilities in the designated upwind states.

On April 6, 2022, EPA published a proposed rule to implement Federal Implementation Plan (FIP) requirements for 26 upwind states to reduce emissions of ozone precursors that are stated to impact attainment and maintenance with the 2015 National Ambient Air Quality Standard (NAAQS) for ozone in downwind states. EPA takes this action under the "Good Neighbor" provisions of the Clean Air Act. The proposed rule requires implementation of state-level emission budgets for fossil-fuel fired EGU, paired with a trading program. The rule also requires certain upwind states to implement numerical emissions standards for Nitrogen Oxides (NOx) for some industrial categories, including pulp and paper manufacturers.

The proposal raises a number of technical and applicability questions, including the treatment of biomass and emissions standards for multi-fuel boilers. The webinar discussed the technical feasibility of NOx control in industry boilers and solicited feedback from attendees on their experience with this topic in other regulatory contexts, to help develop focused technical comments on this rule. Ongoing work on understanding emissions inventories was also discussed.

Link: <https://www.ncasi.org/events/technical-discussion-on-the-2022-csapr-good-neighbor-proposal/>



NCASI Technical Program Activity Update - Chemical Management & Health Effects *(Presented 6/22)*

This Chemical Management & Health Effects (CMHE) program update covered activity in the FY23 technical studies program. NCASI CMHE staff provided updates on emerging science and regulatory activity related to PFAS, industry relevant activity in the field of Product Stewardship with a focus on California packaging initiatives, and updates on NCASI's work in systematic review to improve the NAAQS scientific process.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-chemical-management-health-effects-jun2022/>



NCASI Technical Program Activity Update - Forest Environment & Sustainability *(Presented 7/22)*

This webinar in NCASI's monthly Technical Program Activity Update Series focused on the Forest Environment & Sustainability Program. Presentations provided updates on four completed or nearly completed projects being supported by NCASI. This includes landscape-level assessment of alternative forest management strategies for optimizing carbon, BMP effectiveness at reducing erosion and sediment delivery in the southeastern US, influence of hardwood control on bird diversity in working pine forests, and reducing deer herbivory in northern hardwood ecosystems.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-forestry-jul2022/>





Climate Change and Forests *(Presented 8/22)*

The 2022 NCASI webinar on Climate Change and Forests was hosted by Dr. Kevin Solarik. Speakers from a variety of institutions provided an overview of climate change in a forest management context.

- New certification expectations on climate change: What do we have to offer, and what more is needed? - Stephen Handler, NIACS
- Improved functionality of the Climate Projection Analysis Tool (CPAT) - Dr. Holly Munro, NCASI
- Climate impacts on fish and wildlife in forested ecosystems - Dr. Olivia LeDee, USGS
- ESG – How did we get here and where are we going? - Adam Costanza, NCASI
- How to make a better omelette without cracking any eggs: Testing a new forest management approach across Canada to increase forest resilience and social acceptability of forestry - Dr. Christian Messier, UQO/UQAM
- Assessing landscape-scale climate-smart forest management opportunities – is it possible? - Dr. Aaron Weiskittel, University of Maine

Link: <https://www.ncasi.org/events/climate-change-and-forests-aug2022/>



NCASI Technical Program Activity Update - Water Resources *(Presented 8/22)*

This webinar provided an update on recent activities in the Water Resources Program. The presentations included a summary of upcoming NCASI Annual Meeting and webcast content, several work products nearing publication, program activities related to PFAS regulation and analytical method development for microplastics, and promotion of probabilistic techniques for deriving water quality criteria.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-water-resources-aug2022/>



Managing Odor at Pulp and Paper Mill Wastewater Treatment Facilities *(Presented 8/22)*

From time to time, some pulp and paper mills face challenges related to odor management at wastewater treatment plants (WWTPs). Identifying the source of mill odors, the offending substances, and remedying the situation is almost always complex and difficult. Presentations in this webinar addressed common sources of odor in pulp and paper mills, methods for sampling and analysis of odorous compounds, models for evaluating WWTP conditions that lead to or reduce generation of odorous compounds, and a variety of management approaches for controlling odor.

Link: <https://www.ncasi.org/events/managing-odor-at-pp-wwtp-aug2022/>



NCASI Technical Program Activity Update - Air *(Presented 10/22)*

This webinar provided a summary of recent federal regulatory work, including discussions on the secondary pollutant modeling and permitting guidance, updates to the Boiler MACT rules, and the proposed CSAPR for NO_x emissions. The webinar also covered ongoing projects in the FY23 Air Program, including updates on research into condensable particulate matter measurement methods, measurement of criteria pollutants from corrugating and converting operations, and air toxics emissions from pulp mill processes.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-air-oct2022/>



NCASI Technical Program Activity Update - Chemical Management & Health Effects *(Presented 11/22)*

This Technical Program Activity Update webinar focused on recent activities in the Chemical Management and Health Effects (CMHE) Program. Presentation topics included recent progress to advance the science of National Ambient Air Quality standards setting, and state and federal PFAS regulatory activity. The session also included a discussion of ongoing projects in the FY23 program, including updates on Chemicals in Products Sheets (ChiPS), CDR reporting data, peer reviewed publication status, and the status of academic collaborations in the field of systematic review.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-chemical-management-health-effects-nov2022/>





Nutrient Source Surveys: Approaches and Use *(Presented 12/22)*

The pulp and paper industry has traditionally addressed the challenge of minimizing nitrogen and/or phosphorus in the final effluent by concentrating on the implementation of management strategies aimed at adequately dosing the supplemental nutrients needed for acceptable treatment performance. If the amount of nitrogen, phosphorus, or both, in the effluent coming out of mill processes exceeds biological growth demands for biochemical oxygen demand (BOD) removal, then the mill has little control because no supplemental nutrient addition is needed. If internal losses of nitrogen and phosphorus can be reduced below those needed for optimizing BOD removal, then tightly controlled supplemental addition of nutrients is possible, especially if the mill implements measures to reduce inlet BOD load.

This webinar presented a step-by-step approach for conducting a nutrient source survey and guidance for incorporating results into a nutrient management program. Results from a case-study mill illustrated the process and nutrient reduction opportunities.

Link: <https://www.ncasi.org/events/nutrient-source-surveys-approaches-and-use/>



NCASI Technical Program Activity Update - Sustainable Manufacturing & Climate *(Presented 12/22)*

This webinar, presented by the Sustainability & Climate Program, covered the applicability of NCASI's screening tool for estimating Scope 3 Greenhouse Gas (GHG) emissions. The WRI/WBCSD Greenhouse Gas Protocol recommends that companies begin investigating Scope 3 through a screening process. NCASI's tool is aligned with the Protocol to calculate Scope 3 emissions at a coarse level so companies can jumpstart efforts in generating a Scope 3 inventory for use in the context of the Protocol and other ESG-related reporting activities. The webinar included a demonstration of the tool, discussion of ongoing activities to support members in developing their Scope 3 inventory, and a question and answer period.

Link: <https://www.ncasi.org/events/ncasi-technical-program-activity-update-sustainable-manufacturing-climate-dec2022/>

Peer-Reviewed Publications



Forest Sustainability Articles

Andersen, B.R., L.P. McGuire, T.B. Wigley, and D.A. Miller. 2022. Habitat associations of overwintering bats in managed pine forest landscapes. *Forests* 13(5):803. <https://doi.org/10.3390/f13050803>

Coble, A.A., C.S. Sanchez, W.J. Arthurs, and C.A. Flinders. 2022. Detection and accumulation of environmentally relevant glyphosate concentrations delivered via pulse- or continuous-delivery on passive samplers. *Science of the Total Environment* 838, Part 2: 156131. <https://doi.org/10.1016/j.scitotenv.2022.156131>

Cook, R.C., L.A. Shipley, J.G. Cook, M.J. Camp, D.S. Monzingo, S.L. Robotcek, S.L. Berry, I.T. Hull, W.L. Myers, K. Denryter, and R.A. Long. 2022. Sequential detergent fiber assay results used for nutritional ecology research: Evidence of bias since 2012. *Wildlife Society Bulletin* 46(4):1-26. <https://doi.org/10.1002/wsb.1348>

Denryter, K., R.C. Cook, J.G. Cook, and K.L. Parker. 2022. Animal-defined resources reveal nutritional inadequacies for woodland caribou during summer–autumn. *Journal of Wildlife Management* 86(2):e22161. <https://doi.org/10.1002/jwmg.22161>

Fielding, J.A.H., B.S. Hawks, W.M. Aust, M.C. Bolding, and S.M. Barrett. 2022. Estimated erosion from clearcut timber harvests in the southeastern United States. *Forest Science* 68(3):334-342. <https://doi.org/10.1093/forsci/fxac013>

Hawks, B.S., W.M. Aust, M.C. Bolding, S.M. Barrett, E. Schilling, and J.A.H. Fielding. 2022. Linkages between forestry best management practices and erosion in the southeastern U.S. *Journal of Environmental Management* 305:114411. <https://doi.org/10.1016/j.jenvman.2021.114411>

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Hawks, B.S., W.M. Aust, M.C. Bolding, S.M. Barrett, and E.B. Schilling. 2022. Audit procedures and implementation rates for forest water quality Best Management Practices in the 13 southeastern states. *Journal of Soil and Water Conservation* 77(5):501-515. <https://doi.org/10.2489/jswc.2022.00082>

Hawks, B.S., M.C. Bolding, W.M. Aust, S.M. Barrett, E. Schilling, and C.L. Norton. 2022. Implementation of forestry best management practices and sediment delivery in three regions of North Carolina and Virginia. *Forest Science* 68:63-74. <https://doi.org/10.1093/forsci/fxab057>

Loehle, C., J.P. Verschuyf, and K.A. Solarik. 2022. Population trends and vital rates for marbled murrelet (*Brachyramphus Marmoratus*) in the Pacific Northwest, USA. *Northwestern Naturalist* 103(1):20-29. <https://doi.org/10.1898/1051-1733-103.1.20>

Marshall, C.D., J.C. Maerz, A.L. Larsen-Gray, M.J. Chamberlain, and J.A. Martin. 2022. Gopher tortoise (*Gopherus polyphemus*) resource selection within a private working pine (*Pinus spp.*) forest landscape. *Forest Ecology and Management* 510:120112. <https://doi.org/10.1016/j.foreco.2022.120112>

Martin, M.E., M.S. Delheimer, K.M. Moriarty, D.A. Early, K.A. Hamm, J.N. Pauli, T.L. McDonald, and P.N. Manley. 2022. Conservation of rare and cryptic species: challenges of uncertainty and opportunities for progress. *Conservation Science and Practice* 4(11):e12809. <https://doi.org/10.1111/csp2.12809>

Monzingo, D.S., L.A. Shipley, R.C. Cook, and J.G. Cook. 2022. Factors influencing predictions of understory vegetation biomass from double sampling techniques. *Wildlife Society Bulletin* 46(3):e1300. <https://doi.org/10.1002/wsb.1300>

Puhlick, J.L., A.R. Weiskittel, I.J. Fernandez, K.A. Solarik, and D.J.H. Sleep. 2022. Evaluation of projected carbon accumulations after implementing different forest management treatments in mixed-species stands in northern Maine. *Carbon Management* 13(1):190-204. <https://doi.org/10.1080/17583004.2022.2063761>

Royal, E.J., D.U. Greene, D.A. Miller, and J.D. Willson. 2022. Influence of landscape and vegetation characteristics on herpetofaunal assemblages in Gulf Coastal Plain pine forests. *Journal of Wildlife Management* 86(3):e22199. <https://doi.org/10.1002/jwmg.22199>

Warren, D.R., D.A. Roon, A.G. Swartz, and K.D. Bladon. 2022. Loss if riparian forests from wildfire lead to increased stream temperatures in summer, yet salmonid fish persisted. *Ecosphere* 13:e4233. <https://doi.org/10.1002/ecs2.4233>



Water Resources Articles

Barnhart, B., C. Flinders, G. Johnson, P. Wiegand, P. Anderson, E. Morrison, and G. Houck. 2022. Ambient water quality criteria derived using probabilistic risk assessment. *Integrated Environmental Assessment and Management* 19(2):501-512. <https://doi.org/10.1002/ieam.4683>

Barnhart, B., and C. Flinders. 2022. A review of regulatory modeling frameworks supporting numeric water quality criteria development in the United States. *Integrated Environmental Assessment and Management* 19(1):191-201. <https://doi.org/10.1002/ieam.4653>

Johansen Mattingly, A., P. Wiegand, and R. Sackellares. 2022. Considerations in managing wastewater odor at pulp and paper operations. *TAPPI Journal*. 21(3):167-175. <https://doi.org/10.32964/TJ21.3.167>

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