AGENDA

Commission for the Environment
March 9, 2015
7:30 p.m.

Richard Whitted Meeting Facility (Room 250)
300 West Tryon Street, Hillsborough

Time	Item	Title
7:30	**I.**	**Call to Order**
7:32	**II.**	**Additions or Changes to Agenda**
7:35	**III.**	**Approval of Minutes – February 9** (Attachment 1)
7:40	**IV.**	**Reports** ➢ Intergovernmental Parks Work Group (Wegman) ➢ Orange Unified Transportation Board (Saunders) ➢ NC Clean Tech Summit (Bouma)
7:50	**V.**	**County installs new DC Fast Charger stations** Bouma (Orange County Sustainability Coordinator) will provide an overview of the County's recent installation of DC Fast Charger stations for electric vehicles. (Attachment 2)
8:10	**VI.**	**Committee Meetings** The CFE will consider a draft schedule for developing articles for public outreach on subjects from the State of the Environment report. The CFE will then break out into its standing committees (Air & Energy, Land, Water) to continue work on priority tasks. (Attachments 3-4)
8:45	**VII.**	**Updates and Information Items** Staff and/or CFE members will provide updates on the following items: ➢ Commercial food waste recyclers in Orange County (Attachment 5) ➢ Hydrilla-borne bacteria affecting bald eagles (Attachment 6) ➢ County may propose $125M bond (Attachment 7) ➢ Orange County Proposed Legislative Agenda 2015 (Attachment 8) ➢ Criminal charges filed against Duke Energy for coal ash spills (Attachment 9) ➢ House bill would require incineration of sewage sludge (Attachment 10) ➢ 8,000 acres protected around Jordan Lake (Attachment 11) ➢ New Tesla battery will power your home (Attachment 12) ➢ Planetary boundaries guiding human development (Attachment 13) ➢ 4th graders to receive one-year pass to national parks (Attachment 14) ➢ Your electric vehicle may not be so green (Attachment 15)
9:00	**VIII.**	**Adjournment**

Next meetings: April 13 (Solid Waste Admin. Building – Chapel Hill)
May 11 (Whitted Building – Hillsborough)

CFE Meeting Ground Rules *(Adopted 9/12/11)*

1. Keep to agenda topic under discussion
2. Share relevant information
3. One person speaks at a time after recognition by the Chair
4. Everyone is invited to participate in discussions / no one person should dominate discussions
5. Strive to reach consensus first before voting

Activities the CFE expects to carry out in 2015:

- Continue to update the Orange County State of the Environment 2014 report
- Convene an Energy Task Force (or equivalent work group) to improve the County's ability to foster local sustainable energy production and energy efficiency strategies
- Recommend ways to reduce the County's "carbon footprint" and implement the County's Environmental Responsibility Goal
- Help with public outreach and management efforts related to hydrilla in Eno River
- Help initiate the development of a comprehensive conservation plan for Orange Co
- Collaborate with NC Botanical Garden and others to identify significant roadside habitat for native plants; ask NCDOT and other utilities to protect those roadside habitats [authorized by BOCC June 2012]
- Co-sponsor the annual DEAPR photography contest (*The Nature of Orange*)
- Help plan for and participate in DEAPR's annual Earth Day event

Concerns or emerging issues the CFE has identified for 2015:

- The CFE will continue to advocate for an expansion of the County's commercial food waste pickup and composting services to reduce food waste in the solid waste stream
- The CFE remains interested in developing incentives for increasing energy efficiency in new construction [January 2012 memo to Planning Board]
- The CFE will strive to learn more about environmental justice matters and incorporate relevant information and considerations in the State of the Environment 2014 report
- The CFE will follow closely the Solid Waste Advisory Group's discussions of how to improve the handling and disposal of Orange County's solid waste, and will advocate for better long-term solutions
- The CFE will continue to advocate for increased efforts to gather information related to water resources in Orange County and will continue to increase public awareness and understanding of water supply sources, related concerns, and what steps can be undertaken to maintain or improve the quantity and quality of Orange County water supply resources
- The CFE will continue to address, as appropriate, the critical environmental issues for Orange County as enumerated on page 3 of the 2014 State of the Environment report, which include potential adverse effects from a) invasive, non-native, plant and animal species; b) reductions in State-led collection of water resources data; c) potential drilling for natural gas in the Deep River basin; d) urban sprawl; and CFE support for e) the responsible deployment of clean and appropriately-sited renewable energy and reductions in energy use to help fight climate change

Attachment 1

Orange County
Commission for the Environment

DRAFT Meeting Summary

February 9, 2015
Orange County Solid Waste Administration Building, Chapel Hill

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PRESENT: Jan Sassaman (Chair), May Becker, Peter Cada, Tom Eisenhart, Loren Hintz, David Neal, Bill Newby, Jeanette O'Connor, Sheila Thomas-Ambat, Lydia Wegman, and David Welch

ABSENT: Donna Lee Jones, Rebecca Ray, Gary Saunders

STAFF: Rich Shaw, Tom Davis, Brennan Bouma, David Stancil

GUESTS: Penny Rich (County Commissioner), Eric Gerringer, Muriel Williman, Lynne Gronback

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I. **Call to Order** – Sassaman called the meeting to order at 7:35 pm.

II. **Additions or Changes to Agenda** – Sassaman changed the order of Items III and IV.

IV. **Welcome New Member** – Sassaman introduced two guests: Commissioner Penny Rich and Lynne Gronback, science teacher at Cedar Ridge High School. Sassaman then welcomed Tom Eisenhart to the commission. Eisenhart said he is a Ph.D. candidate in the Department of Chemistry at UNC, but his educational background includes studies in both the technical and social science aspects of sustainability. He served on the Renewable Energy Special Projects Committee at UNC.

III. **Minutes** – Sassaman asked for comments on the January 12 meeting summary. O'Connor motioned to approve; seconded by Wegman. Approved unanimously.

V. **Composting of Food Waste** – Sassaman introduced Eric Gerringer and Muriel Williman—both with the Orange County Solid Waste Management Department. Gerringer provided an overview of the County's Recycling Program, including recent enhancements to the urban and rural curbside recycling. He described current efforts to compost commercial and residential food waste. The collection of commercial food waste from 35 sites (mostly restaurants and grocery stores) is handled by Brooks Contracting. Participants must produce at least one ton per month. Three new sites were added in the past year. Gerringer said 1,500 tons of food waste and other compostable organic matter is diverted from the landfill disposal each year. He said residential collection is currently available at the Walnut Grove convenience center, and in 2016 collection will also be available at the Eubanks Road facility.

Wegman asked what problems are there with the commercial program, and requested a list of participants. Gerringer said there is contamination of the food waste, which requires education and monitoring for quality control. Thomas-Ambat asked how contaminants are removed. Gerringer said plastics, foil and other materials are removed upon inspection. He said he will provide a list of participants in the program.

Becker noted that the CFE had sent a resolution of its support for expanding the food waste collection and composting to the BOCC, and hoped something would result from that action. Gerringer said the program is fully funded at the present time; there is room

for more participation and they've not had to turn down any prospective sources. He noted, however, that the budget for next year will be developed soon. Commissioner Rich said the Solid Waste Advisory Group (SWAG) would be looking into the program beginning this coming Friday's meeting (February 13).

Finally, Gerringer said the University of North Carolina collects 50 tons of food waste each month from three cafeterias on campus. Commissioner Rich noted that the County is discussing a partnership with UNC and the hospital on all recyclables.

Williman provided an overview of the Solid Waste department's education and outreach services, including her efforts to reduce the amounts of solid waste at special events such as Hog Day, Festifall, and Farm to Fork. She described recent progress with the recycling in the Chapel Hill-Carrboro City School system.

Wegman asked if there was anything the CFE could do to help. Gerringer and Rich invited CFE members to attend the SWAG meetings and to participate in the discussion. Hintz added that the CFE could also help by publicizing solid waste recycling programs as part of the CFE's forthcoming public outreach efforts.

CFE members thanked Gerringer and Williman for their presentations.

VI. **Hydrilla in the Eno River** – Davis presented information about hydrilla, an invasive submerged aquatic weed that is infesting portions of the Eno River. Davis described the problems caused by hydrilla and the difficulties with getting rid of it from ponds and waterways. He said it has been a problem at Lake Orange since the early 1990s and was first documented in Eno River State Park in 2005. A 2013 survey found that about 25 miles of the river contained hydrilla—15 miles of which had "heavy infestation."

Davis said he is a member of the Eno River Hydrilla Management Task Force, a group of federal, state, and local government representatives that have been working since 2007 to evaluate and address this situation. The available options include no action, physical removal, biological control, and the use of EPA-approved herbicides.

Davis reported the task force is preparing a two-year pilot study to evaluate the use of EPA-approved herbicide to manage hydrilla in a section of the Eno River below Hillsborough's drinking water intake at Lake Ben Johnston. He has organized a public information open house to be held on April 29 at the Whitted Building in Hillsborough.

He asked the CFE to help with the public outreach effort to educate citizens about hydrilla and to invite them to the public information meeting. O'Connor asked what are the sources of hydrilla in the Eno and would this herbicide treatment have any lasting effect. Davis said the likely sources are residential aquariums, boat paddles, or boat trailers. He said this is a pilot study to determine the effectiveness of the treatments. If it works then it could be one of the options to help manage this aquatic weed. Other CFE members asked questions about the proposed study. Shaw noted that the Water Resources Committee had identified hydrilla as a topic for public outreach, using the information contained in the SOE report. The CFE thanked Davis for his presentation.

VII. **Public Outreach** – CFE members continued their discussion of ways to convey information from State of Environment report to the general public. Sassaman asked each committee to identify its initial topic and who will prepare the draft article.

Wegman reported she had spoken with Mark Schultz, editor of the Chapel Hill News, about including the CFE's series of articles in his newspaper. She said Schultz is willing to publish articles of 550 to 600 words. Shaw said the News of Orange County will also include the articles, but he is not yet sure of the length. Shaw will report back on this.

Before breaking out into the committees, Sassaman asked Shaw if there was anything particularly noteworthy to discuss from the update and information items.

IX. **Updates and Information Items** – Information on the following subjects was provided in the meeting package: a) Earth Evening (April 24), b) County delivers recycling roll cars to rural service, c) County to install additional electric vehicle charging stations, d) Hillsborough historic district eases process for solar panels, e) Leaks persist at coal ash ponds, f) OWASA annual report to Orange County, g) NC Botanical Garden hires new director, h) covering parking lots with solar panels, i) the social cost of carbon due to climate change, and j) cities setting targets to reduce greenhouse gas emissions.

Shaw asked CFE members to consider helping with the County's Earth Evening event to be held on April 24 at River Park in Hillsborough.

VIII. **Committee Meetings** - Sassaman asked members to break into committees to identify its initial topic and who will prepare the draft article. Each of the standing committees met for about 20 minutes.

X. **Adjournment** – Sassaman adjourned at approximately 9:15 pm.

Summary by Rich Shaw, DEAPR Staff

ELECTRIC VEHICLE FAST CHARGE STATIONS

Pictured from left to right: Alan Dorman and Brennan Bouma showcase one of the County's new charging stations

Orange County is installing two DC Fast Charge electric vehicle charging stations. Since 2012, the County has provided 1 level-2 public charging stations, which can fully charge an electric vehicle (EV) in four to six hours.

The new Fast Chargers will charge cars in about 20 minutes and should be available by April. Brennan Bouma, will be managing the stations. "Orange County has been at the forefront of sustainable innovations for decades and this is one m example. These stations fill a gap in the expanding network of EV chargers and create a convenient amenity that will draw drivers into our downtowns," said Bouma, the County's new sustainability coordinator.

Alan Dorman with Asset Management Services formed a partnership with NC-based Brightfield Transportation Solutions, bringing these EV chargers to Orange County at no cost. The stations will be located behind the District Attorney's office c East Margaret Lane and behind the Skills Development Center on West Franklin Street. EV drivers will pay a nominal fee Brightfield to use these stations, while the other public charging stations will remain free to use, for at least the near future

Later, a second phase of the installation will involve erecting a 30kW solar canopy above each charger to help offset the station's energy use. While there are more than 200 EV charging stations in North Carolina, there are fewer than 15 other charge stations.

ORANGE COUNTY
BOARD OF COMMISSIONERS

ACTION AGENDA ITEM ABSTRACT
Meeting Date: April 15, 2014

Action Agenda Item No. 7-c

SUBJECT: DC Fast Charger Electric Vehicle Station Licensing Agreement with Brightfield Transportation Solutions

DEPARTMENT: Asset Management Services, Department of Environment, Agriculture, Parks & Recreation, County Attorney

PUBLIC HEARING: (Y/N) No

ATTACHMENT(S):
1) Site Locator
2) Typical Installation Illustrative
3) Licensing Agreement

INFORMATION CONTACT:
Jeff Thompson, 919-245-2658
David Stancil, 919-245-2522
John Roberts, 919-245-2318

PURPOSE: To consider:

1) Approving a Licensing Agreement and associated Easements granted to Brightfield Transportation Solutions for electric vehicle "DC Fast Charger" fueling station construction and operations at The Justice Facility parking lot in Hillsborough, NC and the Skills Development Center parking lot in Chapel Hill, NC;

2) authorizing the Chair to sign all necessary documents upon final review of the County Attorney.

BACKGROUND: Orange County is a leader in North Carolina (among both the public and private sectors) in developing and offering for use electric vehicle charging stations to its residents and stakeholders.

In 2011 the Board of County Commissioners authorized staff to secure an $83,540 grant with the United States Department of Energy and its Carolina Blue Skies & Green Jobs Initiative for the installation of 16 "Level 2" electric vehicle charging stations. These funds were accepted in November 2011, and the 16 stations were successfully installed in 2012. Attachment 1, "Site Locator", illustrates where these charging stations are installed and publicly available. The Agenda Abstract for the November 15, 2011 grant acceptance and installation authorization can be found at http://www.co.orange.nc.us/OCCLERKS/111115.htm - see Item 5-i.

The installations of these charging stations have seen significant growth in use and popularity as plug-in electric vehicles become more mainstream and popular with consumers. This growth in use is a significant objective of the grant. Because of this demonstrated success and growth,

assisted by Orange County's vision and leadership, the Carolina Blue Skies Initiative suggested that Orange County be considered for private sector partnership with Brightfield Transportation Solutions ("Brightfield") for the licensing agreement where Brightfield would finance, install and operate two "DC Fast Charger" electric vehicle stations - one near the Eno River Farmers Market in Hillsborough, NC, and one near the Chapel Hill/Orange County Visitors Center and Orange County Skills Development Center in Chapel Hill, NC. The existing "Level 2" stations will provide a complete electric vehicle charge in approximately 6 to eight hours, depending on the charging system of the vehicle. The DC Fast Charger station technology allows for a full re-charge in approximately 30 minutes to one hour. This technology will allow for owners of electric vehicles to visit areas for much shorter time frames to receive a full charge - something that is appealing to most electric vehicle owners, especially those visiting and spending dollars within Orange County.

The County's proposed contribution to this initiative is only the conveyance of a utility easement for the locations of the property. Brightfield will permit, design, install, and own the facilities and will charge a nominal fee for the charging service. Brightfield will offer the County and its local government partners (Chapel Hill, Carrboro, Hillsborough, Orange County Schools and Chapel Hill-Carrboro City Schools, and OWASA) a discount to these charging services should these entities invest in the plug-in electric vehicles now and into the future.

The Agreement stipulates the parking areas as not exclusive to electric vehicles; however, they would be include signage as electric vehicle charging areas.

The licensing arrangement proposes a nine year term upon the final commissioning of the stations, with a mutually agreed option for a five year renewal period of the license and/or a mutually agreed buyout provision of the stations at the end of the license term. The full proposed licensing agreement is provided at Attachment 3.

If the licensing agreement is approved, the Board of County Commissioners will be presented the utility easements for approval after Brightfield secures all of the necessary regulatory approvals for the development.

FINANCIAL IMPACT: There is no cost to the County for this licensing agreement. Should the County exercise its mutually agreed buyout option at the end of the term, the County would purchase the facilities for a negotiated fair market value at that time.

RECOMMENDATION(S): The Manager recommends that the Board:

1) approve a Licensing Agreement and grant the associated Easements to Brightfields Transportation Services, LLC for electric vehicle "DC Fast Charger" fueling station construction and operations at The Justice Facility parking lot in Hillsborough, NC and the Skills Development Center parking lot in Chapel Hill, NC;

2) authorize the Chair to sign all necessary documents upon final review of the County Attorney.

Attachment 1

Site Locator

Justice Facility Parking Area - 106 East Margaret St

Skills Development/Visitors Center - 501 W Franklin St

Attachment

Orange County
Department of Environment, Agriculture, Parks and recreation

Memorandum

To: Commission for the Environment
From: Rich Shaw
Date: March 4, 2015
Subject: **Articles for** Public Outreach (State of the Environment Report 2014)

The CFE has discussed various ways of conveying information from the State of the Environment report to the general public. One method is newspaper articles.

In February CFE members agreed to develop monthly articles for publishing in the Chapel Hill News and The News of Orange County. The articles could then be reformatted for other forms of printed and electronic media.

The following is a proposed calendar for writing and publishing the articles:

DRAFT Calendar for 2015

Topic	SOE	Committee (Lead)	Completion	Publication
Hydrilla in the Eno	pp. 69-70	Water (Cada/Davis)	March 15	early April
Solarize projects	N/A	Air & Energy (Neal/Bouma)	April 15	early May
Pollinator Issues	pp. 43-44	Land (O'Connor/Shaw)	May 15	early June
Potential effects of fracking in Orange Co.	pp. 71-72	Water (_____/Davis)	June 15	early July
WISE program	N/A	Air & Energy (____/Bouma)	July 15	early Aug
Terrestrial invasives / choosing native spp.	pp. 43-44	Land Resources (Hintz/Shaw)	Aug 15	early Sept
Water conservation	pp. 47- 54	Water (____/Davis)	Sept 15	early Oct
Barriers to solar development	N/A	Air & Energy (_____/Bouma)	Oct 15	early Nov
Land conservation	pp. 37-42	Land (Wegman/Shaw)	Nov 15	early Dec
Reconsider schedule for 2016 (change to quarterly?)				

Environment, Agriculture, Parks and Recreation
PO Box 8181 / 306-A Revere Road
Hillsborough, NC 27278
(919) 245-2510

Attachment 4

CFE Committee Priorities

(as of February 2015)

Air and Energy Resources Committee

(May Becker, Tom Eisenhart, David Neal, Bill Newby, Gary Saunders, Jan Sassaman)

1. GHG Emissions Inventory - Update the County 2005 greenhouse gas emissions inventory. (First determine whether it will be feasible & worthwhile to perform a complete update.)
2. Green Building – Help County implement a rebate on permit fees for green construction.
3. Climate Change - Educate county residents about climate change, alternative energy sources and efficiency, and steps to reduce their (and the county's) carbon footprint.
4. Energy Efficiency - Partner with Piedmont Electric Membership Corp. to take advantage of USDA program for low-interest loans for energy efficient upgrades for its members/owners.
5. RENEW Group – Proceed with the creation of the planned Renewable Energy and Efficiency Work Group (utilizing the current CFE / Air & Energy Committee structure).

Water Resources Committee

(Peter Cada, Donna Lee Jones, Rebecca Ray, Sheila Thomas-Ambat)

1. Invasive Species – Educate the public about invasive species of concern, their extents/ locations, and what steps can be taken to address them.
2. Surface and Ground Water Quality - Increase the collection of data for surface and ground water quality; increase public education so it might lead to more funding for data collection.
3. Water Supply - Increase public education of our water supply, and what steps can be taken to improve/maintain quality and quantity of water supplies into the future.

Land Resources Committee

(Loren Hintz, Jeanette O'Connor, Lydia Wegman, David Welch)

1. Comprehensive Conservation Plan - Initiate development of a comprehensive conservation plan for Orange County, to be used by Lands Legacy program and others to protect natural areas and wildlife habitat. Consider ways to ensure conservation land is distributed equitably throughout the county so that everyone has reasonable access to enjoy these areas.
2. Native Plant Habitats - Renew collaboration with NC Botanical Garden and others to identify significant roadside habitat for native plants; then ask NCDOT and other utilities to eliminate the use of herbicides to manage vegetation in those special roadside habitats.
3. Native Landscaping - Educate the public (homeowners/businesses) on reasons to choosing a diversity of regionally native species for landscaping and other ways to promote biodiversity in the home landscape.
4. 2016 Bond Package - Advocate for including land conservation (i.e., support for Lands Legacy program) as part of the planned bond package for 2016; take the lead in educating the public about why protected space and natural areas are important for Orange County.

Food Waste Recycling Establishments in Orange County
(as of February 2015)

411 West
Bagel Bar
Breadmen's
Carol Woods
Carolina Brewery
Carolina Inn
Chapel Hill Catering Company
Fosters Market
Granville Towers
Harris Teeter, Chapel Hill North
Harris Teeter, U-Mall
Hillsborough Barbeque Company
IFC Homeless Shelter
K&W Cafeteria
Mama Dips Kitchen
Margaret's Cantina
Oishii

Piedmont Food & Ag Processing Center
Queen of Sheba
Red Lotus
Rizzo Center
Squids Seafood Restaurant
The Lantern
The Pig
Top of the Hill
UNC Hospital
Victoria Park Florist
Vimala's
Weaver St. Market - Carrboro
Weaver St. Market - Food House
Weaver St. Market - Hillsborough
Weaver St. Market - Southern Village
Whole Foods
Weathervane Restaurant

Eric Gerringer | Recycling Programs Manager| Orange County Recycling
Orange County Solid Waste Management Department |1207 Eubanks Road| P.O. Box 17177 |
Chapel Hill, NC 27516 | Office 919.968-2788 | Fax 919.932.2900

ORANGE COUNTY
NORTH CAROLINA

Alarm for eagles

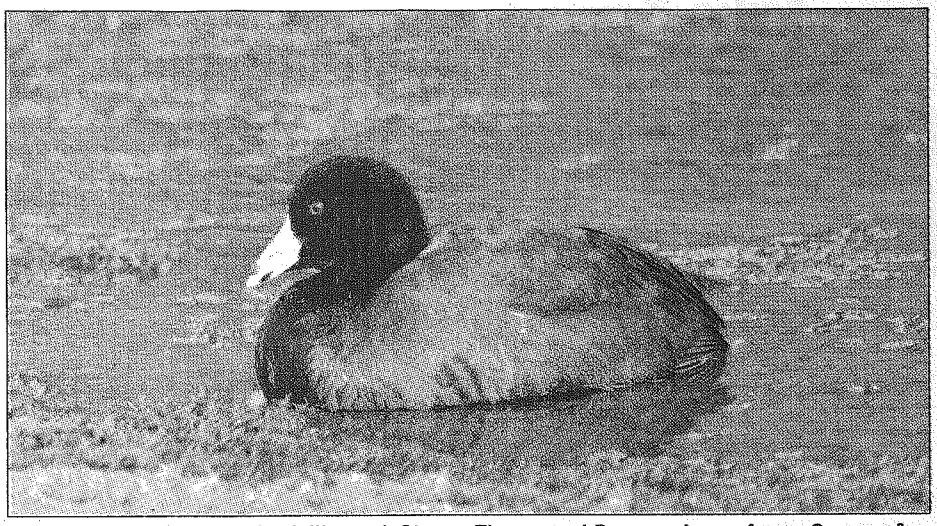
News + Observer
3/2/15

AETOKTHONOS HYDRILLICOLA, UBIQUITOUS IN INVASIVE HYDRILLA PLANTS, GOES UP FOOD CHAIN TO SLAY BIRDS OF PREY

By Darryl Fears
Washington Post

Working late in a tiny Arkansas lab, Susan Wilde found herself alone with a killer.

It startled her. She jumped, let out a yelp, and took off down a hall. Wilde wasn't running for her life; she was amazed by a discovery. She had uncovered a bacterium, one with a powerful toxin that attacked waterfowl, hiding on the underside of an aquatic leaf that grows nearly everywhere in the United States.



This sick coot floats in hydrilla at J. Strom Thurmond Reservoir, an Army Corps of Engineers impoundment on the Savannah River on the South Carolina-Georgia line.

After 20 years of testing determined that the bacterium had never before been recorded, and the brain lesions it causes had never before been found before that night in 1994, Wilde recently gave her discovery a name: *Aetokthonos hydrillicola*. The Greek word "aetokthonos" means "eagle killer," and it is named for its ability to quickly kill the birds of prey. It's the latest threat to a raptor that is starting to flourish after being removed from the endangered species list.

Wilde

Across the South, near reservoirs full of invasive plants from Asia called hydrilla, eagles have been stricken by the bacteria, which go straight to their brains. Eagles prey on American coots, which dine almost exclusively on hydrilla.

Before now, reservoirs that serve up a buffet of this plant were considered beneficial because they helped fuel the annual migration of coots from Canada to Florida and beyond, while also feeding eagles. But now the reservoirs are "death traps," said Wilde, an assistant professor at the University of Georgia whose study of the topic was recently published in the journal Phytotaxa. In Arkansas, Georgia, Florida, South Carolina and North Carolina, coots, shorebirds, ducks and eagles are dying by the dozens from the incurable lesions.

"We're attracting them to places where they're going to die, and that's not a good thing," Wilde said.

SEE **EAGLES,** PAGE 3C

Possible solution?

Stopping the spread of Aetokthonos hydrillicola might not be easy, but one idea involves releasing grass-eating carp into affected lakes, a tactic that was successful in Lake Murray in South Carolina, where 64,000 carp ate 3,880 acres of the invasive plant over two years. Unfortunately, this non-native, sterile carp consumes other desirable water plants important for fish and wildlife habitat.

PHYS.ORG/NEWS

PHOTOS BY

A bald eagle in Georgia: Eagles prey on American coots, which dine almost exclusively on hydrilla, an invasive aquatic plant. Bacteria that can grow on the underside of hydrilla leaves contain a powerful toxin that infects waterfowl – including coots.

EAGLES

CONTINUED FROM PAGE 1C

Before joining the faculty at Georgia, Wilde worked for S.C. Department of Natural Resources and was a research assistant professor at the University of South Carolina.

From coots to eagles

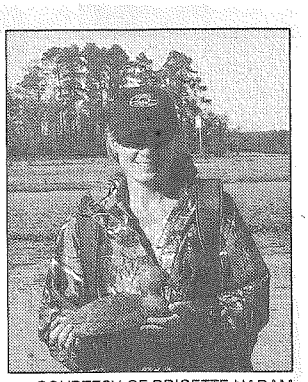
Eagles get top billing in the study because they're the national symbol, arguably the most-recognized animal in America. But the bacteria and its toxin hit coots harder. The migration of coots is a spectacle that bird watchers flock to man-made reservoirs to see. Five thousand can descend at once on a single lake, noisy, splashing, feeding.

The only way to save the animals is to spend millions to eradicate a plant that was introduced to the United States in Florida about 60 years ago. It now grows in virtually every body of fresh water, from the Southeast to the Pacific Northwest.

Wilde said eagles don't mess around when they dine on coots – a dark, plump, duck-like bird with a bright orange dot for an eye. Even the head is fair game. They leave nothing but the feet, Wilde said. She theorized that the bacteria enter eagles while they're munching on the coots' guts. "The only way we can tell a bird has it is they have a characteristic in the brain, a lesion," she said. "There's no damage to any other part of the body."

The eagle killer might hide on the underside of leaves because it prefers shade, but Wilde and her fellow researchers haven't figured out why. The bacteria radiate outward in a circle with strange edges and, she said, spikes. "It looks like it would kill eagles," she said.

Bald eagles were removed from the federal endangered species list only seven years ago. They nearly went extinct when their habitat was clear-cut in the past century, their prey (such as ducks) was over-hunted and a pesticide caused them to lay eggs with shells so thin their chicks couldn't survive. In 1978, they were listed as endangered in every state on the U.S. mainland but five, where they were listed as threatened.



COURTESY OF BRIGETTE HARAM

Brigette Haram, holding a coot decoy she found on the shore, has tracked the killer bacteria as far north as North Carolina.

Wilde and Brigette Haram, a doctoral student at the Warnell School of Forestry and Natural Resources where Wilde teaches, conducted lab trials on chickens and mallard ducks to better understand the toxin, and studied other birds that were brought in acting disoriented and sick. "We haven't seen a species that's immune," Wilde said.

A hopeful observation is that many coots and eagles fly into reservoirs and lakes in the six affected states and fly away unharmed. Seemingly, that is. They could easily fly off and die elsewhere. "We don't know why some birds, within a week of arriving, die. But others come back the next year, conceivably," Wilde said.

Haram isn't a co-author of the study, but she's trying to track the killer wherever it lives. So far, she's only found it as far north as North Carolina. Tests in Virginia and New York were negative. She hasn't tested in the Chesapeake Bay area, but it's on her to-do list.

Wilde was working in South Carolina when she first came across the bacteria in 1994. The bacteria were a master of disguise, taking on the same hue as the slim hydrilla leaf. She had been searching for the bacteria for days until she decided to shine light on the subject.

"The pigment shows up. It looks pretty. It just looks kind of scary and bright and red," she said.

chapelhillnews.com

Feb. 4, 2015

County may propose $125M bond

2016 referendum could help repair aging city, county schools

By Tammy Grubb
tgrubb@newsobserver.com

HILLSBOROUGH The Orange County Board of Commissioners, after appearing to reach a consensus last week, decided to wait until the public weighs in before asking voters for up to $125 million in 2016.

A bond, if approved, could pay for some of the $330 million in repairs and upgrades the Chapel Hill-Carrboro and Orange County schools need. It also could address other needs, such as affordable housing and parks, the commissioners said at their annual retreat.

The state only lets counties hold bond referendums in even election years, which means the county's next opportunity to ask voters will be during the May 2016 primary or the November 2016 general election.

The debt could require a 4.67-cent increase in the county's property tax rate, said Paul Laughton, interim finance director.

The only other option is using money alreay set aside for other construction projects, he said, but that also could require a tax increase and delay meeting other needs.

A penny on the county's current tax rate – 85.8 cents per $100 in assessed property value – raises $1.6 million. The owner of a $250,000 home now pays $2,145 a year in county property tax; the proposed increase could add $116.75.

SEE **BOND,** PAGE 5A

BOND

CONTINUED FROM PAGE 1A

Chapel Hill and Carrboro residents also pay property taxes to their towns and a special Chapel Hill-Carrboro school district tax. Hillsborough residents pay town taxes but not the school tax.

The county's last bond referendum, in 2001, provided $75 million for schools, affordable housing, senior center projects and and parks and recreation.

The county has a AAA bond rating – the highest possible – and could get very low interest rates right now, Laughton said, but that might not be true in the future. The county also is seeing moderate growth in sales tax revenues but not as much money from property taxes, he said.

A future property tax increase may be unavoidable, he said. Many city and county schools are several decades old, and the state has cut funding over the years that local districts could use to pay for repairs.

The city schools also are considering the possibility that a new elementary school might be needed by 2019. That plan could be delayed by at least a decade if the renovations also make room for more students, Commissioner Mia Burroughs said.

Commissioner Mark Dorosin has made similar comments and said Friday the county should talk more with the schools about how to do that. He also suggested talking with the schools about how to open recreational fields to public Parks and Recreation programs.

The timing of a bond referendum is another concern for commissioners, because the town of Chapel Hill is considering a separate bond vote this year.

The Town Council could ask voters to support $40 million to $50 million in bond financing to pay for needed construction projects, including affordable housing and new police and fire stations. Commissioners are worried that voters could be averse to taking on more debt.

County Manager Bonnie Hammersley expects to meet with Chapel Hill Town Manager Roger Stancil in February to talk about the governments' mutual interests, including bond money for affordable housing.

Grubb: 919-932-8746

ORANGE COUNTY
BOARD OF COMMISSIONERS

ACTION AGENDA ITEM ABSTRACT
Meeting Date: March 3, 2015

Action Agenda Item No. 5-d

SUBJECT: Orange County's Proposed 2015 Legislative Agenda

DEPARTMENT: County Commissioners

PUBLIC HEARING: (Y/N) Yes

ATTACHMENT(S):
1) Public Hearing Notice

UNDER SEPARATE COVER

2) Proposed Orange County 2015 Legislative Matters Resolution on Statewide Issues with Exhibits
3) NCACC 2015-16 Adopted Legislative Goals

INFORMATION CONTACT:
Commissioner Bernadette Pelissier, 245-2130
Commissioner Renee Price, 245-2130
Greg Wilder, County Manager's Office, 919-245-2300

PURPOSE: To:

1) Conduct a public hearing on Orange County's potential legislative items for the 2015 North Carolina General Assembly Session;
2) Close the public hearing and review and discuss the Legislative Issues Work Group's (LIWG) proposed 2015 legislative package and any other potential items for inclusion in Orange County's legislative agenda package for the 2015 North Carolina General Assembly Session;
3) Consider approval of one proposed legislative matters resolution on Statewide Issues; and
4) Consider identifying three to five specific items from the entire package to highlight for priority discussion at the March 23, 2015 meeting with Orange County's legislative delegation.

BACKGROUND: The North Carolina General Assembly convened on Wednesday, January 14, 2015. In past years the Board of Commissioners has appointed two Commissioners to serve on a Legislative Issues Work Group (LIWG) to work with staff to develop a proposed legislative package for the County. Based on the work of the LIWG, the BOCC has then reviewed and approved packages of legislative items to pursue for the respective North Carolina General Assembly sessions. Commissioners Bernadette Pelissier and Renee Price are serving on the 2015 LIWG and have worked with staff on the proposed 2015 legislative package which is attached.

At its February 17, 2015 regular meeting, the Board had been scheduled to approve an item on the Consent agenda noting tonight's (March 3rd) public hearing on Orange County's proposed 2015 legislative agenda. With the cancellation of the February 17th meeting, staff alternatively published a Press Release alerting the public regarding tonight's public hearing. Staff also subsequently published the public hearing notice in three different local newspapers detailing tonight's public hearing. The notice of the public hearing was also posted on the County's website and on Facebook and Twitter.

After closing the public hearing, the Board will likely want to review and discuss the LIWG's proposed 2015 legislative package items and any other items as may be addressed during the public hearing. The Board will then need to consider the legislative matters resolution based on the public hearing and Board discussion.

The proposed legislative matters resolution (Attachment 2) for Board consideration addresses a broad range of statewide issues.

Following consideration of the resolution, and in preparation for its March 23, 2015 meeting with Orange County's legislative delegation, the Board may want to consider identifying three to five specific items from the entire package to highlight for priority discussion.

The work of the Legislative Issues Work Group to this point is based on the current information available for the 2015 General Assembly Session. The issues addressed by the Group may evolve and change over the session and require additional attention by the Group and Board of Commissioners. New issues may also arise necessitating additional review.

For reference purposes only, staff has provided the North Carolina Association of County Commissioners (NCACC) 2015-16 Adopted Legislative Goals (Attachment 3) which were adopted by NCACC in late January 2015. Some of the items in the legislative matters resolution regarding statewide issues (Attachment 2) generally coincide with NCACC's goals and those items are noted in the resolution accordingly.

FINANCIAL IMPACT: There is no financial impact associated with holding a public hearing other than the newspaper advertisement costs which were included in the approved FY 2014-15 budget.

RECOMMENDATION(S): The Manager recommends the Board:

1) Conduct a public hearing on Orange County's potential legislative items for the 2015 North Carolina General Assembly Session;
2) Close the public hearing and review and discuss the Legislative Issues Work Group's (LIWG) proposed 2015 legislative package and any other potential items for inclusion in Orange County's legislative agenda package for the 2015 North Carolina General Assembly Session;
3) Approve the proposed legislative matters resolution on Statewide Issues; and
4) Consider identifying three to five specific items from the entire package to highlight for priority discussion at the March 23, 2015 meeting with Orange County's legislative delegation.

Attachment 1

ORANGE COUNTY BOARD OF COMMISSIONERS
PUBLIC HEARING NOTICE
FOR
Tuesday, March 3, 2015 at 7:00 p.m.

A public hearing will be held on Orange County's potential legislative agenda for the 2015 North Carolina General Assembly Session. The issue areas to be addressed include:

- Revenue and Taxation
- Mental Health
- Transportation Responsibility
- Smart Start and NC Pre-K
- Broadband
- Bond Referendum for Education
- Jail/Inmate Reimbursement
- E-911 Funds
- Preservation Trust Fund Support
- Agriculture/Solar Energy
- Use Value Program
- Concealed Weapons in Parks
- Classification of Flavored Alcoholic Beverages
- Solid Waste Programs/Recycling Authority
- County Civil Rights Ordinance – Additional Authority
- Sales Tax Distribution

The Board of Commissioners welcomes all comments on all items as may be introduced or addressed at the public hearing. The meeting is open to the public and will be held on Tuesday, March 3, 2015 at the Whitted Meeting Facility at 300 West Tryon Street in Hillsborough beginning at 7:00 p.m. If you need additional information or would like to provide written comments, please contact Greg Wilder at 919-245-2300 or ocbocc@orangecountync.gov.

DRAFT **Attachment 2**

RES - 2015 - 010

NORTH CAROLINA

ORANGE COUNTY

RESOLUTION REGARDING
LEGISLATIVE MATTERS

BE IT RESOLVED by the Board of County Commissioners of Orange County that the Board hereby requests the Senator and Representatives representing Orange County take the following positions on legislation regarding the following Statewide matters:

1) *** Revenue Options for Local Government** - Support legislation that authorizes any local government to enact any revenue source that is presently available to one or more local governments in the state. Local governments have experienced significant budget cuts in recent years. Providing flexibility regarding revenue options to fund local government services will allow local governments to tailor their respective funding plans based on individual needs and goals;

2) *** Oppose any shift of state transportation responsibilities to counties** - Oppose legislation to shift the state's responsibility for funding transportation construction and maintenance projects to counties. Counties cannot afford to assume costs for

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An item denoted with a "*" generally coincides with a similar North Carolina Association of County Commissioners (NCACC) 2015-16 Legislative Goal.

maintaining secondary roads and/or funding expansion projects. Unlike counties in other states, whose traditional funding responsibilities are secondary roads, North Carolina counties are responsible for the administration of local human services programs, and fund educational operating and capital expenses;

3) *** Broadband** - Support legislation, funding, and other efforts to expand broadband capability to the un-served and under-served areas of the State to enhance quality of life as well as expand opportunities for jobs creation, small business development, and growth in farm enterprises. Orange County opposes legislation limiting local governments' efforts to provide broadband and supports legislation and regulations that would preserve local option and authority where needed to deploy community broadband systems and ensure community access to critical broadband services;

4) **Smart Start and NC Pre-K** - Support legislation to increase and ensure secure and stable funding, enhanced quality early care and education, and family access and benefits in settings public and private. The County advocates sustaining teacher quality, evidence-based learning objectives, healthy life styles, and community engagement. Quality early childhood education has

proven to help alleviate the achievement gap, curb the need for costly services (including special education), and reduce societal cost by increasing graduation rates. Recent studies have shown a significant return on investment for dollars supporting early childhood programs and services. Orange County Schools and Chapel Hill-Carrboro City Schools are ardent allies in ensuring that actions at the state level support local implementation. Orange County remains strongly supportive of the Orange County Partnership for Young Children in the effective administration and evaluation of services reaching all children throughout the County;

5) **County Jail System/Housing State Inmates Reimbursement** - Support legislation to protect the fiscal viability of the county jail system by reinstating reimbursement for state inmates housed in county jails sentenced to 90 days or less and increase the reimbursement rate for state inmates awaiting post-trial prison transfer;

6) **Agriculture/Solar Energy** - Support renewable energy initiatives to create a market for agricultural-sourced energy credits. Both provide incentives for farmers to produce renewable energy, which will become increasingly important to preserving and strengthening

the agricultural economy and rural infrastructure as well as maintaining Orange County's rural heritage and culture;

7) **Authority to Amend the Orange County Civil Rights Ordinance** - Seek legislative action to provide the County the authority to include sexual orientation and gender identity as protected classes. The Board of Commissioners adopted the Orange County Civil Rights Ordinance in 1994 with the purpose and policy to promote the equal treatment of all individuals. In subsequent years, the County has requested, to no avail, additional legislative authority to amend the Ordinance to include additional protected classes;

8) *** E-911 Funds** - Support permanently extending the authorization to use E911 funds for all public safety disciplines. Orange County has appreciated past efforts and supports future initiatives to expand the uses for these funds within the public safety disciplines related to emergency communications and Emergency Medical Services;

9) *** Mental Health** - Support the current model of public mental health administration, opposes any further consolidation, and seeks legislation to ensure that

adequate State-funded mental health, developmental disability, and substance abuse services and facilities are available at the local level, accessible and affordable to all residents and that sufficient state resources fund service provision costs inclusive of sufficient crisis beds, and to structure appropriate county participation in governance.;

10) *** Child Care** - Seek legislation to reverse changes made to the childcare subsidy program available to working families, including the eligibility change of 200% of the federal poverty level to 133%, which harms many working parents who are trying to become more financial self-sufficient, and the provision change that requires nonparent relatives living with the child to have their income counted for child care eligibility;

11) **Land, Water and Agricultural Preservation Funding** - Support Park, Agricultural Preservation, Clean Water and other existing trust funds established for the protection of the State's land, water, biological resources, agriculture, and special places before they are irreversibly lost, and requests that these funds receive additional funding;

12) **Agriculture - Support Conservation of Working Lands and Farmland Preservation** - Support a revision to the revenue and acreage requirements of the Use Value Program to reduce acreage requirements and increase the income threshold;

13) **Machinery Act** - Support local governments' need for more flexibility to remedy measurement and/or condition property appraisal errors related to local property tax functions. North Carolina property tax law substantially limits the ability of local governments to address property tax discrepancies, such as prohibiting the refund of prior years' taxes paid after a measurement and/or condition property appraisal error is discovered. Just as local governments can recoup prior years' property taxes from owners for "discoveries", local governments should likewise be authorized to refund prior years' taxes paid when situations such as measurement and/or condition property appraisal errors are discovered;

14) **Homestead Exemption** - Support revisions to the Homestead Exemption provisions of the Machinery Act to

a) provide greater opportunities for low-income seniors to remain in their homes and not be displaced due to property tax burdens by

approving a one-time ten percent (10%) increase in the income qualification standard; and maintaining the current provisions which increase the income qualification standard each year based on any cost-of-living adjustment made to the benefits under Titles II and XVI of the Social Security Act for the preceding calendar year;

b) diminish the discriminatory features of the current exemption provisions relating to married couples by establishing graduated income qualification standards for single individuals versus married couples; and

c) address the ineffectiveness of the exemption provisions in communities where property values increase at substantial rates over short periods of time by capping the increase in additional taxes to be paid to the increase in the Consumer Price Index (CPI) for the preceding year;

15) **Bond Referendum for Education** - Support a statewide bond referendum to provide State assistance to meet public school and community college construction needs caused by increased enrollment, mandated reduction in class size and other factors;

16) **Concealed Weapons in Parks** - Seek legislation re-authorizing counties to fully regulate the carrying of concealed weapons on county-owned playgrounds and in county-owned parklands;

17) *** Participation in Solid Waste Programs for Recycling** - Authorize counties to require county residents to impose a fee for the solid waste collection services in a manner similar to the authority granted to municipalities. The fee may not exceed the costs of collection;

18) **Sales Tax Distribution Formula** - Support legislation directing that all sales tax be distributed on a per capita basis; and

19) **Classification of Flavored Alcoholic Beverages (Alcopops)** - Support legislation to properly classify flavored alcoholic beverages (alcopops) as distilled spirits rather than malt beverages.

An item denoted with a "*" generally coincides with a similar North Carolina Association of County Commissioners (NCACC) 2015-16 Legislative Goal.

100 Counties One State

2015

Legislative Session

North Carolina Association of County Commissioners

Guiding Principles and Legislative Goals

Priority Goals

1 **HH-1:** Support continued state funding of Medicaid and support efforts by the state to provide healthcare access for all citizens.

2 **PE-1:** Seek legislation to restore the statutory requirement that 40% of the net lottery proceeds be allocated to counties for school capital needs and increase the annual appropriation of lottery funds until the 40% allocation is restored.

3 **PE-4:** Seek legislation to repeal the statutory authority under N.C. G.S. 115C-431(c) that allows local school boards to file suit against a county board of commissioners over county appropriations for education.

4 **GG-1:** Oppose any shift of state transportation responsibilities to counties.

5 **TF-1**: Oppose unfunded mandates and shifts of state responsibilities to counties.

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Agriculture Goals & Guiding Principles

Guiding Principles

- The Association supports local control over land-use decision-making and its impact on the agricultural community.
- The Association supports state policies providing local options and tools for the preservation of farmland, if they serve the best interest of all counties.
- The Association supports research, education and outreach with various public and private partnerships that result in agricultural development opportunities, sustainable initiatives producing low-cost food and energy that will, in turn, create healthy local economies.
- Agricultural issues related to the environment transcend governmental boundaries and require close coordination of policy and action by federal, state and local governments.
- Powers delegated to the counties for the protection of the public health are important for protecting the land and water resources that are vital for agricultural endeavors.
- The General Assembly should provide funds for any increased county responsibility related to animal control operations and/or facilities.

Goals

AG-1: Support state funding and staffing for agricultural research, Cooperative Extension services and other agriculture-related efforts to support the largest economic driver in North Carolina.

AG-2: Support legislation to authorize farmers to grow industrial hemp as a cash crop.

- Demand has grown for hemp for a variety of uses, such as fibers for upholstery and clothing, paper-type products, twine, and oil for lip balm.
- Hemp products are not illegal in North Carolina, but growing hemp is.
- Allowing hemp to be grown in North Carolina provides an additional crop for farmers and supports agriculture in our state.

ENV-2: Seek legislation to establish a mechanism for local governments to recover costs associated with providing services or reversing negative effects on the community related to the natural gas and oil exploration industry and coal ash storage.

- The Energy Modernization Act from 2014 prohibits local governments from assessing any tax (aside from property tax) on an individual or business engaged in energy mineral activities, and it provides no mechanism for local governments to access revenue from state taxes on the industry.
- The costs to local governments are difficult to determine with such a new industry in North Carolina, but counties need a means to recover potential costs such as employee time for deed and tax assessment changes, employee training, and emergency management activities.

ENV-3: Seek legislation to clarify that counties have the authority to establish by ordinance a program for the collection of residential recyclable materials and to charge fees to recover the costs.

- While some counties are running residential recycling programs, a resident has challenged the program in one county, and statutory authority is unclear. A clarification to the statute would remove any doubt as to such authority.

newsobserver.com

Criminal charges filed against Duke Energy for NC coal ash spills

Misdemeanor counts stem from coal ash spills in 4 N.C. rivers

By Bruce Henderson and Anne Blythe, The Charlotte Observer February 20, 2015

CHARLOTTE, N.C. — Federal prosecutors Friday filed criminal charges against Duke Energy for illegal discharges from ash ponds across North Carolina, where a massive spill a year ago triggered intense scrutiny of the company's environmental management.

Duke said it has reached a settlement agreement with the federal government over nine misdemeanor violations of the Clean Water Act. The settlement would end an investigation of its ash handling that began with a spill into the Dan River on Feb. 2, 2014.

Duke would pay $68.2 million in fines and restitution and $34 million for community service and mitigation projects. The money will come from shareholders, not customers.

The settlement has to be reviewed and approved by a federal judge. U.S. Attorney Thomas Walker of the Eastern District, where the cases will be transferred, said he would have no comment until they come before a judge.

"We are accountable for what happened at Dan River and have learned from this event," Duke CEO Lynn Good said in a statement. "We are setting a new standard for coal ash management and implementing smart, sustainable solutions for all our ash basins. Our highest priorities are safe operations and the well-being of the people and communities we serve."

A criminal bill of information filed in U.S. District Court in Charlotte charges Duke with coal ash and wastewater discharges from an unpermitted drain at the Riverbend power plant west of Charlotte. A second, similar count is for the Asheville plant.

A third, filed in Raleigh, alleges a discharge of coal ash and coal ash wastewater from an unpermitted drainage ditch near the H.F. Lee Steam Electric Plant in Goldsboro into the Neuse River. The time period for that discharge was no later than Oct. 2010 through the end of 2014.

Other charges are connected to the spill and illegal discharges at the Dan River plant and maintenance issues at the Cape Fear power plant in Chatham County, Duke said.

The charges say Duke "negligently" discharged the pollutants. Employees failed to "exercise the degree of care that someone of ordinary prudence would have exercised" and aided and abetted each other.

The charges are misdemeanors.

Duke revealed a proposed settlement of the charges Wednesday in an earnings report that put $102 million into a litigation account.

The possibility of criminal charges had hung over the nation's biggest electric utility for a year.

A February 2014 spill of 39,000 tons of coal ash turned the Dan River the color of cement. The spill prompted a public outcry, investigations and – occurring in Eden, the hometown of N.C. Senate leader Phil Berger – legislators' scrutiny.

Within weeks, a federal grand jury in Raleigh began probing a "suspected felony" involving Duke's coal ash handling.

Wide-ranging subpoenas to Duke, 18 current or former state environmental regulators and the utilities commission demanded inspection records, correspondence and enforcement documents regarding the 108 million tons of ash stored at power plants scattered across the state.

Advocates accused Duke and the administration of Gov. Pat McCrory, a former Duke Energy employee, of working together to avoid harsh punishment for the company.

Groundwater contamination apparently from coal ash has been found at each of Duke Energy's 14 North Carolina coal-fired plants. Duke has reported leaks that drain more than 3 million gallons a day.

The federal charges and settlement sting a fast-growing company that until Feb. 2, 2014, had largely avoided public embarrassment in recent decades.

The Dan River spill happened months before the Environmental Protection Agency issued the first national standards on coal ash. And while it was the third-largest spill of the past decade, Duke's was the only one of the three to result in criminal charges.

The difference? An apparent determination by federal prosecutors that Duke willfully broke the law.

Dam inspectors repeatedly warned Duke to stay alert for signs of leakage into the 48-inch stormwater pipe that broke under an ash pond at the retired Dan River power plant in Eden, records show.

Only after the pipe broke did Duke learn that it was made of metal, not the much stronger concrete that the utility had assumed.

The North Carolina Department of Environment and Natural Resources says the federal settlement won't affect state lawsuits over Duke's ash ponds – filed under pressure from advocacy groups – or investigation of groundwater contamination.

DENR cited Duke for eight violations at seven power plants after the spill but has levied no fines. In March, DENR cited Duke for violations after the company pumped 61 million gallons of water from ash ponds into a tributary of the Cape Fear River.

About a dozen environmental groups have been allowed to join the state's four lawsuits, giving them a say in any settlements regarding 12 of the 14 power plants. The groups have also filed federal lawsuits against several Duke power plants, all still before the courts.

A $100 million settlement would be second largest under the landmark 1972 Clean Water act if it were solely a fine. Instead, the settlement is expected to include money for community-service and mitigation projects.

The Dan River spill

The EPA declared the cleanup of the Dan River finished in July, after Duke vacuumed up 3,000 tons of ash and sediment. More than 90 percent of the spilled ash was left in the river. EPA said removing it would do more harm than good.

The U.S. Fish and Wildlife Service, working with North Carolina, Virginia and Duke, is leading an assessment of the environmental damage. It's likely to end with Duke paying for restoration projects in the Dan River basin.

A Duke-commissioned study in November found freshwater mussels are thriving in the Dan. North Carolina's Department of Environment and Natural Resources reported that the river-bottom bugs and worms at the base of the food chain are also healthy.

Other experts say one year is far too short a time to gauge the long-term effects of the potentially toxic metals in ash on the river. Metals in the river bottom may recirculate into the water.

Bruce Henderson

Read more here: http://www.newsobserver.com/2015/02/20/4570946_criminal-charges-filed-against.html?rh=1#storylink=cpy

Wednesday, February 11, 2015

charlotteobserver.com

House bill requires incineration for sludge

A Cabarrus County legislator wants to give his county a defense against Charlotte's sewage sludge, which some of his constituents have rallied against in recent months.

Rep. Larry Pittman, a Concord Republican, is among the primary sponsors of the bill filed Tuesday. **The bill lets counties that incinerate sludge -- that would be Cabarrus -- require that sludge be burned before it's spread as fertilizer on farm fields.**

Counties without incinerators could force an "alternate method" of sludge treatment to reduce disease-carrying pathogens and rodents.

Charlotte Water's opponents in the Rowan-Cabarrus community of Gold Hill say they're more worried about heavy metals and toxic chemicals tainting soil and groundwater.

The utility this month withdrew an application to expand its sludge fields by 1,300 acres in Cabarrus, Rowan and Iredell counties. But its existing North Carolina permit expires March 31 and will have to be renewed, so could apparently be affected by the sludge bill.

Charlotte Water canceled the request after the state cited a Rowan County property that would have been included in the expansion for environmental violations.

Cabarrus County, meanwhile, cranked up a new, $20 million power plant fueled by sludge last October. The county landfills the ash that's left.

Cabarrus says it would welcome Charlotte's sludge, but the city has said incineration is not a viable alternative for economic and other reasons.

Pittman's Republican cosponsors are Rep. Carl Ford of Rowan County and Rep. Michael Speciale of Craven County. The bill now goes to the House Local Government committee, which Ford co-chairs, and if endorsed there to the Environment committee.

Pat McCrory, Governor
Donald R. van der Vaart, Secretary

February 13, 2015

State and federal agencies sign agreement to protect 8,000 acres around Jordan Lake

RALEIGH – State and federal officials have signed an agreement that protects nearly 8,000 acres of environmentally rich land around Jordan Lake, the source of drinking water for much of the Triangle.

Under the arrangement, the U.S. Army Corps of Engineers, which owns Jordan Lake and the surrounding property and the state agencies with site management responsibilities in the area, have agreed to maintain 14 separate parcels of land in their existing condition to avoid any damage to their unique characteristics.

"Registry agreements are voluntary arrangements developed between landowners and DENR to manage and protect properties with rare plants, animals or other outstanding natural areas," said Donald R. van der Vaart, secretary of the N.C. Department of Environment and Natural Resources. "By signing this agreement, DENR and its partners will act to protect this land with its diverse wildlife and good examples of the large bottomland forests that once dominated the Triassic Basin."

The Jordan Lake Project includes about 45,000 acres in Chatham, Durham, Orange and Wake counties, and a large reservoir that serves as the drinking water source for Cary, Apex, Durham and a host of other Triangle communities. Much of the 8,000 acres included in the registry agreement is associated with the floodplains and wetlands of the Jordan Lake Project and has been identified by DENR's Natural Heritage Program as having rare or representative examples of ecosystems and natural communities, geologic landforms, and habitats for endangered or threatened plants and animals.

The parties to the registry agreement include the U.S. Army Corps of Engineers, which owns the land, as well as the N.C. Wildlife Resources Commission, DENR (through the N.C. Division of Parks and Recreation), and the N.C. Forest Service – all of which help manage the property.

With permission from landowners, DENR can register and designate areas in North Carolina with rare or diverse features in order to ensure their protection. These registered natural areas

will continue to be used for educational, scientific, ecological, aesthetic, wildlife, fisheries and compatible recreational purposes.

“As species need to be able to move around to meet their needs, the large, mostly contiguous Jordan Lake Project overall is an important conservation area because it helps connect these high-quality habitats for wildlife,” said Scott Pohlman, who works for the state’s Natural Heritage Program and manages the registry program for the state.

A copy of the registry agreement is at:
http://portal.ncdenr.org/c/document_library/get_file?uuid=0442f343-624f-464a-8766-25d3ca25384c&groupId=61587.

The Washington Post http://www.washingtonpost.com/blogs/the-switch/wp/2015/02/12/this-new-tesla-battery-will-power-your-home-and-maybe-the-electric-grid-too/?hpid=z4

This new Tesla battery will power your home, and maybe the electric grid too

By Brian Fung February 12, 2015

Tesla is working on a battery that can power your home and even help large-scale utilities store energy more efficiently, according to company chief executive Elon Musk.

On an investor call Wednesday, Musk said the designs for a home or business battery are already complete and will likely be unveiled to the public "in the next month or two." Production could be as little as six months away, he added.

"It's really great. I'm really excited about it," said Musk.

While there's no word yet on price, Tesla's battery and charging technology could ultimately wind up saving you money on your electric bill. Although many of today's homes draw energy directly from the electricity grid, the spread of cheap solar panels means it's never been easier to generate some of your own energy. Storing renewables efficiently has been a big bottleneck for consumers and for utilities alike, but if Tesla's stationary battery takes off, it could change the way electricity is priced and traded on a market scale. (For years, it's been many people's dream to sell excess energy back to the grid.)

For the millions of consumers frustrated with their power companies thanks to frequent outages and poor customer service, the batteries could be a boon. In general, the choices for how people power their homes is relatively limited. Most have to rely exclusively on their local utility providers. Getting a generator can be expensive -- some homeowners pay around $20,000 for back-up generators that run on natural gas. So Tesla is eyeing a market that might be ripe for innovation.

Morgan Stanley made waves last year when it wrote that Tesla's forthcoming products in this space could meet a huge market demand.

“There may be a 'tipping point' that causes customers to seek an off-grid approach,” Morgan Stanley wrote last March. “The more customers move to solar, the remaining utility customer bill will rise, creating even further “headroom” for Tesla’s off-grid approach.”

Tesla is already laying the groundwork to ensure its stationary batteries get as widely distributed as possible.

"A lot of utilities are working in this space, and we're talking to almost all of them," said Tesla's chief technical officer, JB Straubel. "It’s early stage stuff and a lot of these projects are very far out since the procurement cycle for utilities is so long. But this is a business that certainly is gaining an increasing amount of our attention."

RESEARCH ARTICLE SUMMARY

SUSTAINABILITY

Planetary boundaries: Guiding human development on a changing planet

Will Steffen,* Katherine Richardson, Johan Rockström, Sarah E. Cornell, Ingo Fetzer, Elena M. Bennett, Reinette Biggs, Stephen R. Carpenter, Wim de Vries, Cynthia A. de Wit, Carl Folke, Dieter Gerten, Jens Heinke, Georgina M. Mace, Linn M. Persson, Veerabhadran Ramanathan, Belinda Reyers, Sverker Sörlin

INTRODUCTION: There is an urgent need for a new paradigm that integrates the continued development of human societies and the maintenance of the Earth system (ES) in a resilient and accommodating state. The planetary boundary (PB) framework contributes to such a paradigm by providing a science-based analysis of the risk that human perturbations will destabilize the ES at the planetary scale. Here, the scientific underpinnings of the PB framework are updated and strengthened.

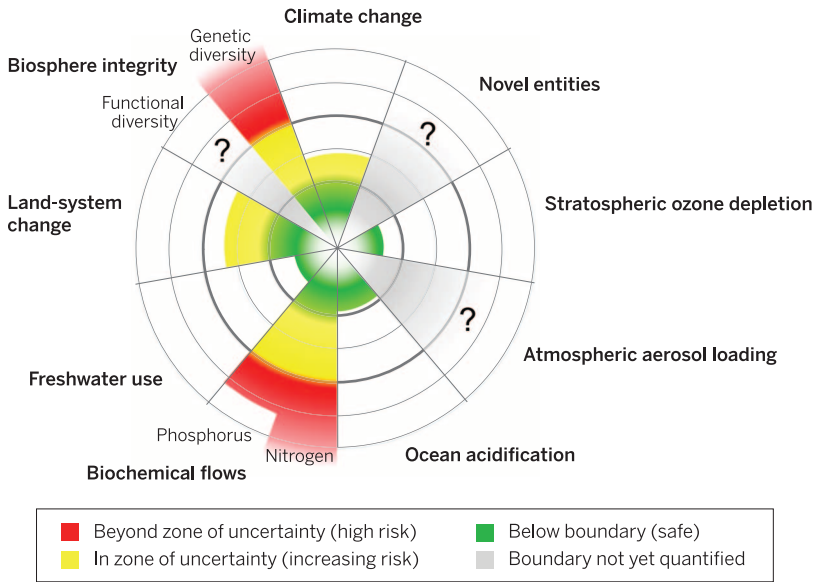
RATIONALE: The relatively stable, 11,700-year-long Holocene epoch is the only state of the ES that we know for certain can support contemporary human societies. There is increasing evidence that human activities are affecting ES functioning to a degree that threatens the resilience of the ES—its ability to persist in a Holocene-like state in the face of increasing human pressures and shocks. The PB framework is based on critical processes that regulate ES functioning. By combining improved scientific understanding of ES functioning with the precautionary principle, the PB framework identifies levels of anthropogenic perturbations below which the risk of destabilization of the ES is likely to remain low—a "safe operating space" for global societal development. A zone of uncertainty for each PB highlights the area of increasing risk. The current level of anthropogenic impact on the ES, and thus the risk to the stability of the ES, is assessed by comparison with the proposed PB (see the figure).

RESULTS: Three of the PBs (climate change, stratospheric ozone depletion, and ocean acidification) remain essentially unchanged from the earlier analysis. Regional-level boundaries as well as globally aggregated PBs have now been developed for biosphere integrity (earlier "biodiversity loss"), biogeochemical flows, land-system change, and freshwater use. At present, only one regional boundary (south Asian monsoon) can be established for atmospheric aerosol loading. Although we cannot identify a single PB for novel entities (here defined as new substances, new forms of existing substances, and modified life forms that have the potential for unwanted geophysical and/or biological effects), they are included in the PB framework, given their potential to change the state of the ES. Two of the PBs—climate change and biosphere integrity—are recognized as "core" PBs based on their fundamental importance for the ES. The climate system is a manifestation of the amount, distribution, and net balance of energy at Earth's surface; the biosphere regulates material and energy flows in the ES and increases its resilience to abrupt and gradual change. Anthropogenic perturbation levels of four of the ES processes/features (climate change, biosphere integrity, biogeochemical flows, and land-system change) exceed the proposed PB (see the figure).

CONCLUSIONS: PBs are scientifically based levels of human perturbation of the ES beyond which ES functioning may be substantially altered. Transgression of the PBs thus creates substantial risk of destabilizing the Holocene state of the ES in which modern societies have evolved. The PB framework does not dictate how societies should develop. These are political decisions that must include consideration of the human dimensions, including equity, not incorporated in the PB framework. Nevertheless, by identifying a safe operating space for humanity on Earth, the PB framework can make a valuable contribution to decision-makers in charting desirable courses for societal development. ■

ON OUR WEB SITE

Read the full article at http://dx.doi.org/10.1126/science.1259855



Current status of the control variables for seven of the planetary boundaries. The green zone is the safe operating space, the yellow represents the zone of uncertainty (increasing risk), and the red is a high-risk zone. The planetary boundary itself lies at the intersection of the green and yellow zones. The control variables have been normalized for the zone of uncertainty; the center of the figure therefore does not represent values of 0 for the control variables. The control variable shown for climate change is atmospheric CO_2 concentration. Processes for which global-level boundaries cannot yet be quantified are represented by gray wedges; these are atmospheric aerosol loading, novel entities, and the functional role of biosphere integrity.

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RESEARCH ARTICLE

SUSTAINABILITY

Planetary boundaries: Guiding human development on a changing planet

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The planetary boundaries framework defines a safe operating space for humanity based on the intrinsic biophysical processes that regulate the stability of the Earth system. Here, we revise and update the planetary boundary framework, with a focus on the underpinning biophysical science, based on targeted input from expert research communities and on more general scientific advances over the past 5 years. Several of the boundaries now have a two-tier approach, reflecting the importance of cross-scale interactions and the regional-level heterogeneity of the processes that underpin the boundaries. Two core boundaries—climate change and biosphere integrity—have been identified, each of which has the potential on its own to drive the Earth system into a new state should they be substantially and persistently transgressed.

The planetary boundary (PB) approach (*1*, *2*) aims to define a safe operating space for human societies to develop and thrive, based on our evolving understanding of the functioning and resilience of the Earth system. Since its introduction, the framework has been subject to scientific scrutiny [e.g., (*3*–*7*)] and has attracted considerable interest and discussions within the policy, governance, and business sectors as an approach to inform efforts toward global sustainability (*8*–*10*).

In this analysis, we further develop the basic PB framework by (i) introducing a two-tier approach for several of the boundaries to account for regional-level heterogeneity; (ii) updating the quantification of most of the PBs; (iii) identifying two core boundaries; and (iv) proposing a regional-level quantitative boundary for one of the two that were not quantified earlier (*1*).

The basic framework: Defining a safe operating space

Throughout history, humanity has faced environmental constraints at local and regional levels, with some societies dealing with these challenges more effectively than others (*11*, *12*). More recently, early industrial societies often used local waterways and airsheds as dumping grounds for their waste and effluent from industrial processes. This eroded local and regional environmental quality and stability, threatening to undermine the progress made through industrialization by damaging human health and degrading ecosystems. Eventually, this led to the introduction of local or regional boundaries or constraints on what could be emitted to and extracted from the environment (e.g., chemicals that pollute airsheds or waterways) and on how much the environment could be changed by direct human modification (land-use/cover change in natural ecosystems) (*13*). The regulation of some human impacts on the environment—for example, the introduction of chemical contaminants—is often framed in the context of "safe limits" (*14*).

These issues remain, but in addition we now face constraints at the planetary level, where the magnitude of the challenge is vastly different. The human enterprise has grown so dramatically since the mid-20th century (*15*) that the relatively stable, 11,700-year-long Holocene epoch, the only state of the planet that we know for certain can support contemporary human societies, is now being destabilized (figs. S1 and S2) (*16*–*18*). In fact, a new geological epoch, the Anthropocene, has been proposed (*19*).

The precautionary principle suggests that human societies would be unwise to drive the Earth system substantially away from a Holocene-like condition. A continuing trajectory away from the Holocene could lead, with an uncomfortably high probability, to a very different state of the Earth system, one that is likely to be much less hospitable to the development of human societies (*17*, *18*, *20*). The PB framework aims to help guide human societies away from such a trajectory by defining a "safe operating space" in which we can continue to develop and thrive. It does this by proposing boundaries for anthropogenic perturbation of critical Earth-system processes. Respecting these boundaries would greatly reduce the risk that anthropogenic activities could inadvertently drive the Earth system to a much less hospitable state.

Nine processes, each of which is clearly being modified by human actions, were originally suggested to form the basis of the PB framework (*1*). Although these processes are fundamental to Earth-system functioning, there are many other ways that Earth-system functioning could be described, including potentially valuable metrics for quantifying the human imprint on it. These alternative approaches [e.g., (*4*)] often represent ways to explore and quantify interactions among the boundaries. They can provide a valuable complement to the original approach (*1*) and further enrich the broader PB concept as it continues to evolve.

The planetary boundary framework: Thresholds, feedbacks, resilience, uncertainties

A planetary boundary as originally defined (*1*) is not equivalent to a global threshold or tipping point. As Fig. 1 shows, even when a global- or continental/ocean basin–level threshold in an Earth-system process is likely to exist [e.g., (*20*, *21*)], the proposed planetary boundary is not placed at the position of the biophysical threshold but rather upstream of it—i.e., well before reaching the threshold. This buffer between the boundary (the end of the safe operating space, the green zone in Fig. 1) and the threshold not only accounts for uncertainty in the precise position of the threshold with respect to the control variable

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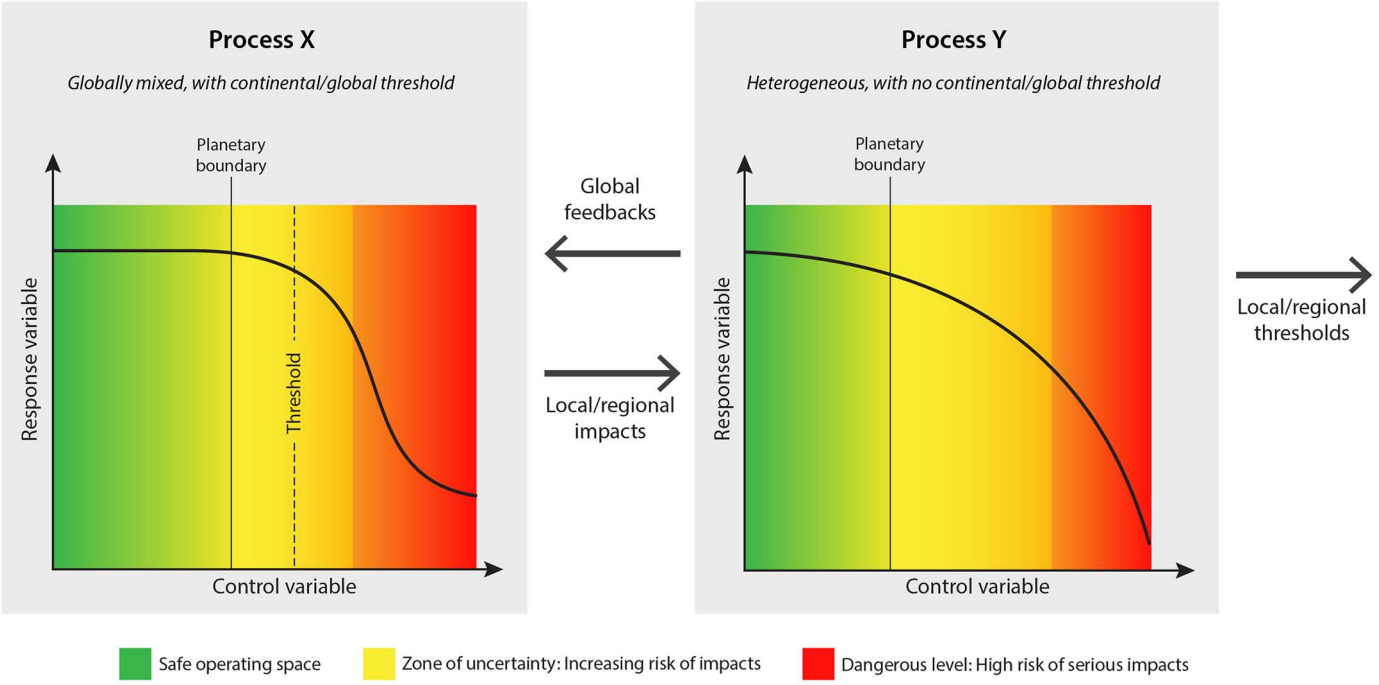

Fig. 1. The conceptual framework for the planetary boundary approach, showing the safe operating space, the zone of uncertainty, the position of the threshold (where one is likely to exist), and the area of high risk. Modified from (*1*).

but also allows society time to react to early warning signs that it may be approaching a threshold and consequent abrupt or risky change.

The developing science of early-warning signs can warn of an approaching threshold or a decrease in the capability of a system to persist under changing conditions. Examples include "critical slowing down" in a process (*22*), increasing variance (*23*), and flickering between states of the system (*24*–*26*). However, for such science to be useful in a policy context, it must provide enough time for society to respond in order to steer away from an impending threshold before it is crossed (*27*, *28*). The problem of system inertia—for example, in the climate system (*18*)—needs to be taken into account in assessing the time needed for society to react to early-warning signs.

Not all Earth-system processes included in the PB approach have singular thresholds at the global/continental/ocean basin level (*1*). Nevertheless, it is important that boundaries be established for these processes. They affect the capacity of the Earth system to persist in a Holocene-like state under changing conditions (henceforth "resilience") by regulating biogeochemical flows (e.g., the terrestrial and marine biological carbon sinks) or by providing the capacity for ecosystems to tolerate perturbations and shocks and to continue functioning under changing abiotic conditions (*29*, *30*). Examples of such processes are land-system change, freshwater use, change in biosphere integrity [rate of biodiversity loss in (*1*, *2*)], and changes in other biogeochemical flows in addition to carbon (e.g., nitrogen and phosphorus). Placing boundaries for these processes is more difficult than for those with known large-scale thresholds (*21*) but is nevertheless important for maintaining the resilience of the Earth system as a whole. As indicated in Fig. 1, these processes, many of which show threshold behavior at local and regional scales, can generate feedbacks to the processes that do have large-scale thresholds. The classic example is the possible weakening of natural carbon sinks, which could further destabilize the climate system and push it closer to large thresholds [e.g, loss of the Greenland ice sheet (*18*)]. An interesting research question of relevance to the PB framework is how small-scale regime shifts can propagate across scales and possibly lead to global-level transitions (*31*, *32*).

A zone of uncertainty, sometimes large, is associated with each of the boundaries (yellow zone in Fig. 1). This zone encapsulates both gaps and weaknesses in the scientific knowledge base and intrinsic uncertainties in the functioning of the Earth system. At the "safe" end of the zone of uncertainty, current scientific knowledge suggests that there is very low probability of crossing a critical threshold or substantially eroding the resilience of the Earth system. Beyond the "danger" end of the zone of uncertainty, current knowledge suggests a much higher probability of a change to the functioning of the Earth system that could potentially be devastating for human societies. Application of the precautionary principle dictates that the planetary boundary is set at the "safe" end of the zone of uncertainty. This does not mean that transgressing a boundary will instantly lead to an unwanted outcome but that the farther the boundary is transgressed, the higher the risk of regime shifts, destabilized system processes, or erosion of resilience and the fewer the opportunities to prepare for such changes. Observations of the climate system show this principle in action by the influence of increasing atmospheric greenhouse gas concentrations on the frequency and intensity of many extreme weather events (*17*, *18*).

Linking global and regional scales

PB processes operate across scales, from ocean basins/biomes or sources/sinks to the level of the Earth system as a whole. Here, we address the subglobal aspects of the PB framework. Rockström *et al.* (*1*) estimated global boundaries only, acknowledging that the control variables for many processes are spatially heterogeneous. That is, changes in control variables at the subglobal level can influence functioning at the Earth-system level, which indicates the need to define subglobal boundaries that are compatible with the global-level boundary definition. Avoiding the transgression of subglobal boundaries would thus contribute to an aggregate outcome within a planetary-level safe operating space.

We focus on the five PBs that have strong regional operating scales: biosphere integrity, biogeochemical flows [earlier termed "phosphorus (P) and nitrogen (N) cycles" (*1*, *2*)], land-system change, freshwater use, and atmospheric aerosol loading. Table S1 describes how transgression of any of the proposed boundaries at the subglobal level affects the Earth system at the global level.

For those processes where subglobal dynamics potentially play a critical role in global dynamics, the operational challenge is to capture the importance of subglobal change for the functioning

of the Earth system. To do this, we propose the development of a two-level set of control variables and boundaries. The subglobal-level units of analysis for these six boundaries are not identical; they vary according to the role that the processes play in the Earth system: (i) changes in biosphere integrity occur at the level of land-based biomes, large freshwater ecosystems, or major marine ecosystems as the largest subglobal unit; (ii) the role of direct, human-driven land-system change in biophysical climate regulation is primarily related to changes in forest biomes; (iii) freshwater flows and use occur at the largest subglobal level in the major river basins around the world; and (iv) changes in biogeochemical flows, exemplified by phosphorus and nitrogen cycling, aggregate from relatively localized but very severe perturbations in intensive agricultural zones to affect global flows of nutrients. We recognize these as critical regions for Earth-system functioning. Where appropriate, the updates of the individual boundaries (see below) (*33*) now contain both the globally aggregated boundary value of the control variable and its regional distribution function. Figure 2 shows the distributions and current status of the control variables for three of the boundaries where subglobal dynamics are critical: biogeochemical cycles, land-system change, and freshwater use.

We emphasize that our subglobal-level focus is based on the necessity to consider this level to understand the functioning of the Earth system as a whole. The PB framework is therefore meant to complement, not replace or supersede, efforts to address local and regional environmental issues.

Updates of the individual boundaries

Brief updates of all nine of the PBs are given in this section, and more detailed descriptions of the updates for three of the PBs that have undergone more extensive revision can be found in (*33*). The geographical distribution issues discussed above are particularly important for five of the PBs, and their control variables and boundaries have been revised accordingly (Table 1). Figure 3 shows the current status of the seven boundaries that can be quantified at the global level.

Climate change

We retain the control variables and boundaries originally proposed—i.e., an atmospheric CO_2 concentration of 350 parts per million (ppm) and an increase in top-of-atmosphere radiative forcing of +1.0 W m^{-2} relative to preindustrial levels (*1*). The radiative forcing control variable is the more inclusive and fundamental, although CO_2 is important because of its long lifetime in the atmosphere and the very large human emissions. Human-driven changes to radiative forcing include all anthropogenic factors: CO_2, other greenhouse gases, aerosols, and other factors that affect the energy balance (*18*). Radiative forcing is generally the more stringent of the two boundaries, although the relationship between it and CO_2 can vary through time with changes in the relative importance of the individual radiative forcing factors.

Evidence has accumulated to suggest that the zone of uncertainty for the CO_2 control variable should be narrowed from 350 to 550 ppm to 350 to 450 ppm CO_2 (*17*, *18*), while retaining the current zone of uncertainty for radiative forcing of +1.0 to 1.5 W m^{-2} relative to preindustrial levels. Current values of the control variables are 399 ppm CO_2 (annual average concentration for 2014) (*34*) and +2.3 W m^{-2} (1.1 to 3.3 W m^{-2}) in 2011 relative to 1750 (*18*). Observed changes in climate at current levels of the control variables confirm the original choice of the boundary values and the narrowing of the zone of uncertainty for CO_2. For example, there has already been an increase in the intensity, frequency, and duration of heat waves globally (*35*); the number of heavy rainfall

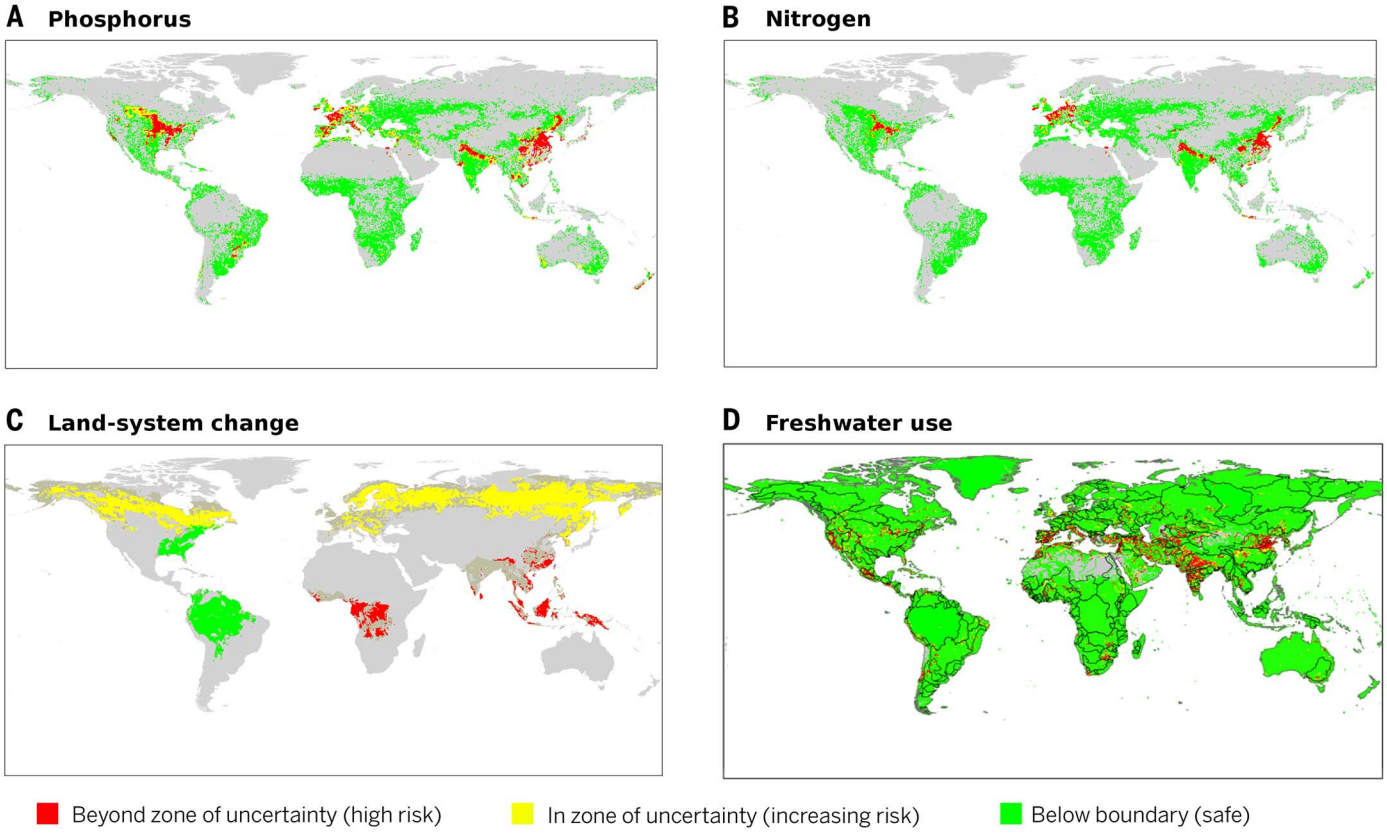

Fig. 2. The subglobal distributions and current status of the control variables for (**A**) biogeochemical flows of P; (**B**) biogeochemical flows of N; (**C**) land-system change; and (**D**) freshwater use. In each panel, green areas are within the boundary (safe), yellow areas are within the zone of uncertainty (increasing risk), and red areas are beyond the zone of uncertainty (high risk). Gray areas in (A) and (B) are areas where P and N fertilizers are not applied; in (C), they are areas not covered by major forest biomes; and in (D), they are areas where river flow is very low so that environmental flows are not allocated. See Table 1 for values of the boundaries and their zones of uncertainty and (*33*) for more details on methods and results.

Table 1. The updated control variables and their current values, along with the proposed boundaries and zones of uncertainty, for all nine planetary boundaries. In the first column, the name for the Earth-system process used in the original PB publication (R2009, reference 1) is given for comparison.

Earth-system process	Control variable(s)	Planetary boundary (zone of uncertainty)	Current value of control variable
Climate change (R2009: same)	Atmospheric CO_2 concentration, ppm	350 ppm CO_2 (350–450 ppm)	398.5 ppm CO_2
	Energy imbalance at top-of-atmosphere, W m^{-2}	+1.0 W m^{-2} (+1.0–1.5 W m^{-2})	2.3 W m^{-2} (1.1–3.3 W m^{-2})
Change in biosphere integrity (R2009: Rate of biodiversity loss)	*Genetic diversity:* Extinction rate	< 10 E/MSY (10–100 E/MSY) but with an aspirational goal of ca. 1 E/MSY (the background rate of extinction loss). E/MSY = extinctions per million species-years	100–1000 E/MSY
	Functional diversity: Biodiversity Intactness Index (BII)	Maintain BII at 90% (90–30%) or above, assessed geographically by biomes/large regional areas (e.g. southern Africa), major marine ecosystems (e.g., coral reefs) or by large functional groups	84%, applied to southern Africa only
	Note: These are interim control variables until more appropriate ones are developed		
Stratospheric ozone depletion (R2009: same)	Stratospheric O_3 concentration, DU	<5% reduction from pre-industrial level of 290 DU (5%–10%), assessed by latitude	Only transgressed over Antarctica in Austral spring (~200 DU)
Ocean acidification (R2009: same)	Carbonate ion concentration, average global surface ocean saturation state with respect to aragonite (Ω_{arag})	≥80% of the pre-industrial aragonite saturation state of mean surface ocean, including natural diel and seasonal variability (≥80%– ≥70%)	~84% of the pre-industrial aragonite saturation state
Biogeochemical flows: (P and N cycles) (R2009: Biogeochemical flows: (interference with P and N cycles))	*P Global*: P flow from freshwater systems into the ocean	11 Tg P yr^{-1} (11–100 Tg P yr^{-1})	~22 Tg P yr^{-1}
	P Regional: P flow from fertilizers to erodible soils	6.2 Tg yr^{-1} mined and applied to erodible (agricultural) soils (6.2-11.2 Tg yr^{-1}). Boundary is a global average but regional distribution is critical for impacts.	~14 Tg P yr^{-1}
	N Global: Industrial and intentional biological fixation of N	62 Tg N yr^{-1} (62–82 Tg N yr^{-1}). Boundary acts as a global 'valve' limiting introduction of new reactive N to Earth System, but regional distribution of fertilizer N is critical for impacts.	~150 Tg N yr^{-1}

Earth-system process	Control variable(s)	Planetary boundary (zone of uncertainty)	Current value of control variable
Land-system change (R2009: same)	*Global:* Area of forested land as % of original forest cover	*Global:* 75% (75–54%) Values are a weighted average of the three individual biome boundaries and their uncertainty zones	62%
	Biome: Area of forested land as % of potential forest	*Biome*: Tropical: 85% (85–60%) Temperate: 50% (50–30%) Boreal: 85% (85–60%)	
Freshwater use (R2009: Global freshwater use)	*Global:* Maximum amount of consumptive blue water use ($km^3 yr^{-1}$)	*Global:* 4000 $km^3 yr^{-1}$ (4000–6000 $km^3 yr^{-1}$)	~2600 $km^3 yr^{-1}$
	Basin: Blue water withdrawal as % of mean monthly river flow	*Basin:* Maximum monthly withdrawal as a percentage of mean monthly river flow. For low-flow months: 25% (25–55%); for intermediate-flow months: 30% (30–60%); for high-flow months: 55% (55–85%)	
Atmospheric aerosol loading (R2009: same)	*Global:* Aerosol Optical Depth (AOD), but much regional variation		
	Regional: AOD as a seasonal average over a region. South Asian Monsoon used as a case study	*Regional*: (South Asian Monsoon as a case study): anthropogenic total (absorbing and scattering) AOD over Indian subcontinent of 0.25 (0.25–0.50); absorbing (warming) AOD less than 10% of total AOD	0.30 AOD, over South Asian region
Introduction of novel entities (R2009: Chemical pollution)	No control variable currently defined	No boundary currently identified, but see boundary for stratospheric ozone for an example of a boundary related to a novel entity (CFCs)	

events in many regions of the world is increasing (*17*); changes in atmospheric circulation patterns have increased drought in some regions of the world (*17*); and the rate of combined mass loss from the Greenland and Antarctic ice sheets is increasing (*36*).

Changes in biosphere integrity

We propose a two-component approach, addressing two key roles of the biosphere in the Earth system. The first captures the role of genetically unique material as the "information bank" that ultimately determines the potential for life to continue to coevolve with the abiotic component of the Earth system in the most resilient way possible. Genetic diversity provides the long-term capacity of the biosphere to persist under and adapt to abrupt and gradual abiotic change. The second captures the role of the biosphere in Earth-system functioning through the value, range, distribution, and relative abundance of the functional traits of the organisms present in an ecosystem or biota (*7*).

For the first role, the concept of phylogenetic species variability (PSV) (*7*, *33*, *37*) would be an appropriate control variable. However, because global data are not yet available for PSV, we retain the global extinction rate as an interim control variable, although it is measured inaccurately and with a time lag. There may be a considerable risk in using extinction rate as a control variable, because phylogenetic (and functional) diversity may be more sensitive to human pressures than species-level diversity (*38*). In principle, the boundary should be set at a rate of loss of PSV no greater than the rate of evolution of new PSV during the Holocene. Because that is unknown, we must fall back on the (imperfectly) known extinction rate of well-studied organisms over the past several

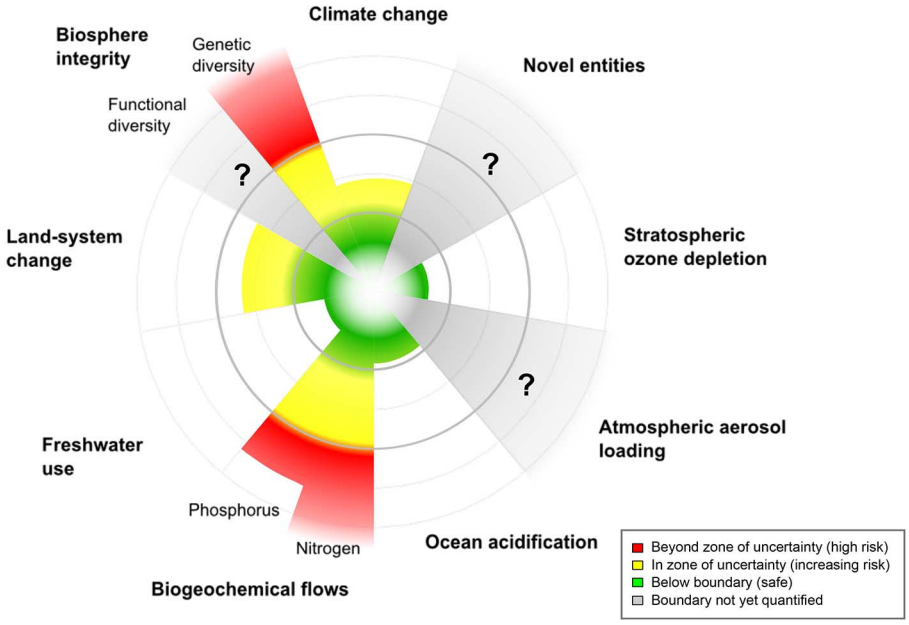

Fig. 3. The current status of the control variables for seven of the nine planetary boundaries. The green zone is the safe operating space (below the boundary), yellow represents the zone of uncertainty (increasing risk), and red is the high-risk zone. The planetary boundary itself lies at the inner heavy circle. The control variables have been normalized for the zone of uncertainty (between the two heavy circles); the center of the figure therefore does not represent values of 0 for the control variables. The control variable shown for climate change is atmospheric CO_2 concentration. Processes for which global-level boundaries cannot yet be quantified are represented by gray wedges; these are atmospheric aerosol loading, novel entities, and the functional role of biosphere integrity. Modified from (*1*).

million years—about 1 per million species-years (*39*)—and add a large uncertainty bound, raising the boundary to 10 per million species-years. The risk is that, although the Earth system can tolerate a higher-than-background level of extinctions for a time, we do not know what levels of, or types of, biodiversity loss may possibly trigger nonlinear or irreversible changes to the Earth system.

The second control variable aims to capture the role of the biosphere in Earth-system functioning and measures loss of biodiversity components at both global and biome/large ecosystem levels. Although several variables have been developed at local scales for measuring functional diversity [e.g., (*40*)], finding an appropriate control variable at regional or global levels is challenging. For the present, we propose an interim control variable, the Biodiversity Intactness Index (BII) (*41*). BII assesses change in population abundance as a result of human impacts, such as land or resource use, across a wide range of taxa and functional groups at a biome or ecosystem level using preindustrial era abundance as a reference point. The index typically ranges from 100% (abundances across all functional groups at preindustrial levels) to lower values that reflect the extent and degree of human modification of populations of plants and animals. BII values for particular functional groups can go above 100% if human modifications to ecosystems lead to increases in the abundance of those species.

Due to a lack of evidence on the relationship between BII and Earth-system responses, we propose a preliminary boundary at 90% of the BII but with a very large uncertainty range (90 to 30%) that reflects the large gaps in our knowledge about the BII–Earth-system functioning relationship (*42*, *43*). BII has been so far applied to southern Africa's terrestrial biomes only (see fig. S3 for an estimation of aggregated human pressures on the terrestrial biosphere globally), where the index (not yet disaggregated to functional groups) was estimated to be 84%. BII ranged from 69 to 91% for the seven countries where it has been applied (*41*). Observations across these countries suggest that decreases in BII adequately capture increasing levels of ecosystem degradation, defined as land uses that do not alter the land-cover type but lead to a persistent loss in ecosystem productivity (*41*).

In addition to further work on functional measures such as BII, in the longer term the concept of biome integrity—the functioning and persistence of biomes at broad scales (*7*)—offers a promising approach and, with further research, could provide a set of operational control variables (one per biome) that is appropriate, robust, and scientifically based.

Stratospheric ozone depletion

We retain the original control variable [O_3 concentration in DU (Dobson units)] and boundary (275 DU). This boundary is only transgressed over Antarctica in the austral spring, when O_3 concentration drops to about 200 DU (*44*). However, the minimum O_3 concentration has been steady for about 15 years and is expected to rise over the coming decades as the ozone hole is repaired after the phasing out of ozone-depleting substances. This is an example in which, after a boundary has been transgressed regionally, humanity has taken effective action to return the process back to within the boundary.

Ocean acidification

This boundary is intimately linked with one of the control variables, CO_2, for the climate change PB. The concentration of free H^+ ions in the surface ocean has increased by about 30% over the past 200 years due to the increase in atmospheric CO_2 (*45*). This, in turn, influences carbonate chemistry in surface ocean waters. Specifically, it lowers the saturation state of aragonite (Ω_{arag}), a form of calcium carbonate formed by many marine organisms. At $\Omega_{arag} < 1$, aragonite will dissolve. No new evidence has emerged to suggest that the originally proposed boundary (≥80% of the preindustrial average annual global Ω_{arag}) should be adjusted, although geographical heterogeneity in Ω_{arag} is important in monitoring the state of the boundary around the world's oceans (fig. S4). Currently, Ω_{arag} is approximately equal to 84% of the preindustrial value (*46*). This boundary would not be transgressed if the climate-change boundary of 350 ppm CO_2 were to be respected.

Biogeochemical flows

The original boundary was formulated for phosphorus (P) and nitrogen (N) only, but we now propose a more generic PB to encompass human influence on biogeochemical flows in general. Although the carbon cycle is covered in the climate-change boundary, other elements, such as silicon (*47*, *48*), are also important for Earth-system functioning. Furthermore, there is increasing evidence that ratios between elements in the environment may have impacts on biodiversity on land and in the sea (*49*–*51*). Thus, we may ultimately need to develop PBs for other elements and their ratios, although for now we focus on P and N only.

A two-level approach is now proposed for the P component of the biogeochemical flows boundary (see also the supplementary materials). The original global-level boundary, based on the prevention of a large-scale ocean anoxic event, is retained, with the proposed boundary set at a sustained flow of 11 Tg P $year^{-1}$ from freshwater systems into the ocean. Based on the analysis of Carpenter and Bennett (*3*), we now propose an additional regional-level P boundary, designed to avert widespread eutrophication of freshwater systems, at a flow of 6.2 Tg P $year^{-1}$ from fertilizers (mined P) to erodible soils.

Given that the addition of P to regional watersheds is almost entirely from fertilizers, the regional-level boundary applies primarily to the world's croplands. The current global rate of application of P in fertilizers to croplands is 14.2 Tg P $year^{-1}$ (*52*, *53*). Observations point toward a few agricultural regions of very high P application rates as the main contributors to the transgression of this boundary (Fig. 2 and fig. S5A) and suggest that a redistribution of P from areas

where it is currently in excess to areas where the soil is naturally P-poor may simultaneously boost global crop production and reduce the transgression of the regional-level P boundary (3, 52, 54).

The N boundary has been taken from the comprehensive analysis of de Vries *et al.* (5), which proposed a PB for eutrophication of aquatic ecosystems of 62 Tg N year^{-1} from industrial and intentional biological N fixation, using the most stringent water quality criterion. As for the P boundary, a few agricultural regions of very high N application rates are the main contributors to the transgression of this boundary (Fig. 2 and fig. S5B). This suggests that a redistribution of N could simultaneously boost global crop production and reduce the transgression of the regional-level boundary.

Because the major anthropogenic perturbation of both the N and P cycles arises from fertilizer application, we can analyze the links between the independently determined N and P boundaries in an integrated way based on the N:P ratio in the growing plant tissue of agricultural crops. Applying this ratio, which is on average 11.8 (55), to the P boundary (6.2 Tg P year^{-1}) gives an N boundary of 73 Tg N year^{-1}. Conversely, applying the ratio to the N boundary (62 Tg N year^{-1}) gives a P boundary of 5.3 Tg P year^{-1}. The small differences between the boundaries derived using the N:P ratio and those calculated independently, which are likely nonsignificant differences given the precision of the data available for the calculations, show the internal consistency in our approach to the biogeochemical boundaries.

More detail on the development of the P and N boundaries is given in (33), where we also emphasize that the proposed P and N boundaries may be larger for an optimal allocation of N (and P) over the globe.

Land-system change

The updated biosphere integrity boundary provides a considerable constraint on the amount and pattern of land-system change in all terrestrial biomes: forests, woodlands, savannas, grasslands, shrublands, tundra, and so on. The land-system change boundary is now focused more tightly on a specific constraint: the biogeophysical processes in land systems that directly regulate climate—exchange of energy, water, and momentum between the land surface and the atmosphere. The control variable has been changed from the amount of cropland to the amount of forest cover remaining, as the three major forest biomes—tropical, temperate and boreal—play a stronger role in land surface–climate coupling than other biomes (56, 57). In particular, we focus on those land-system changes that can influence the climate in regions beyond the region where the land-system change occurred.

Of the forest biomes, tropical forests have substantial feedbacks to climate through changes in evapotranspiration when they are converted to nonforested systems, and changes in the distribution of boreal forests affect the albedo of the land surface and hence regional energy exchange. Both have strong regional and global teleconnections. The biome-level boundary for these two types of forest have been set at 85% (Table 1 and the supplementary materials), and the boundary for temperate forests has been proposed at 50% of potential forest cover, because changes to temperate forests are estimated to have weaker influences on the climate system at the global level than changes to the other two major forest biomes (56). These boundaries would almost surely be met if the proposed biosphere integrity boundary of 90% BII were respected.

Estimates of the current status of the land-system change boundary are given in Figs. 2 and 3 and fig. S6 and in (58).

Freshwater use

The revised freshwater use boundary has retained consumptive use of blue water [from rivers, lakes, reservoirs, and renewable groundwater stores (59)] as the global-level control variable and 4000 km^3/year as the value of the boundary. This PB may be somewhat higher or lower depending on rivers' ecological flow requirements (6). Therefore, we report here a new assessment to complement the PB with a basin-scale boundary for the maximum rate of blue water withdrawal along rivers, based on the amount of water required in the river system to avoid regime shifts in the functioning of flow-dependent ecosystems. We base our control variable on the concept of environmental water flows (EWF), which defines the level of river flows for different hydrological characteristics of river basins adequate to maintain a fair-to-good ecosystem state (60–62).

The variable monthly flow (VMF) method (33, 63) was used to calculate the basin-scale boundary for water. This method takes account of intra-annual variability by classifying flow regimes into high-, intermediate-, and low-flow months and allocating EWF as a percentage of the mean monthly flow (MMF). Based on this analysis, the zones of uncertainty for the river-basin scale water boundary were set at 25 to 55% of MMF for the low-flow regime, 40 to 70% for the intermediate-flow regime, and 55 to 85% for the high-flow regime (table S2). The boundaries were set at the lower end of the uncertainty ranges that encompass average monthly EWF. Our new estimates of the current status of the water use boundary—computed based on grid cell–specific estimates of agricultural, industrial, and domestic water withdrawals—are shown in Figs. 2 and 3, with details in figs. S7 and S8.

Atmospheric aerosol loading

Aerosols have well-known, serious human health effects, leading to about 7.2 million deaths per year (64). They also affect the functioning of the Earth system in many ways (65) (fig. S9). Here, we focus on the effect of aerosols on regional ocean-atmosphere circulation as the rationale for a separate aerosols boundary. We adopt aerosol optical depth (AOD) (33) as the control variable and use the south Asian monsoon as a case study, based on the potential of widespread aerosol loading over the Indian subcontinent to switch the monsoon system to a drier state.

The background AOD over south Asia is ~0.15 and can be as high as 0.4 during volcanic events (66). Emissions of black carbon and organic carbon from cooking and heating with biofuels and from diesel transportation, and emission of sulfates and nitrates from fossil fuel combustion, can increase seasonal mean AODs to as high as 0.4 (larger during volcanic periods), leading to decreases of 10 to 15% of incident solar radiation at the surface (fig. S9). A substantial decrease in monsoon activity is likely around an AOD of 0.50, an increase of 0.35 above the background (67). Taking a precautionary approach toward uncertainties surrounding the position of the tipping point, we propose a boundary at an AOD of 0.25 (an increase due to human activities of 0.1), with a zone of uncertainty of 0.25 to 0.50. The annual mean AOD is currently about 0.3 (66), within the zone of uncertainty.

Introduction of novel entities

We define novel entities as new substances, new forms of existing substances, and modified life forms that have the potential for unwanted geophysical and/or biological effects. Anthropogenic introduction of novel entities to the environment is of concern at the global level when these entities exhibit (i) persistence, (ii) mobility across scales with consequent widespread distributions, and (iii) potential impacts on vital Earth-system processes or subsystems. These potentially include chemicals and other new types of engineered materials or organisms [e.g., (68–71)] not previously known to the Earth system, as well as naturally occurring elements (for example, heavy metals) mobilized by anthropogenic activities. The risks associated with the introduction of novel entities into the Earth system are exemplified by the release of CFCs (chlorofluorocarbons), which are very useful synthetic chemicals that were thought to be harmless but had unexpected, dramatic impacts on the stratospheric ozone layer. In effect, humanity is repeatedly running such global-scale experiments but not yet applying the insights from previous experience to new applications (72, 73).

Today there are more than 100,000 substances in global commerce (74). If nanomaterials and plastic polymers that degrade to microplastics are included, the list is even longer. There is also a "chemical intensification" due to the rapidly increasing global production of chemicals, the expanding worldwide distribution as chemical products or in consumer goods, and the extensive global trade in chemical wastes (75).

In recent years, there has been a growing debate about the global-scale effects of chemical pollution, leading to calls for the definition of criteria to identify the kinds of chemical substances that are likely to be globally problematic (76, 77). Persson *et al.* (73) proposed that there are three conditions that need to be fulfilled for a chemical to pose a threat to the Earth system: (i) the chemical has an unknown disruptive effect on a vital Earth-system process; (ii) the disruptive effect is not discovered until it is a problem at the global scale; and (iii) the effect is not readily

reversible. The challenge to the research community is to develop the knowledge base that allows the screening of chemicals, before they are released into the environment, for properties that may predispose them toward becoming global problems.

As a first step toward meeting this challenge, the three conditions outlined above have been used as the basis for identifying scenarios of chemical pollution that fulfill the conditions and as a next step for pinpointing chemical profiles that fit the scenarios (28). This proposal constitutes a first attempt at adding the Earth-system perspective when assessing hazard and risk of chemicals and offers a vision for a systematic approach to a complex management situation with many unknowns.

Despite this progress in developing an Earth-system–oriented approach, there is not yet an aggregate, global-level analysis of chemical pollution on which to base a control variable or a boundary value. It may also serve little purpose to define boundary values and control variables for a planetary boundary of this complexity. Nevertheless, there is a potential threat from novel entities to disrupt the functioning of the Earth-system and society needs to learn how to mitigate these unknown risks and manage chemicals under uncertainty (28, 73).

Some precautionary and preventive actions can be considered. These may include a stronger focus on green chemistry (78), finding synergies with risk-reducing interventions in other fields such as occupational health (79), paying more attention to learning from earlier mistakes (80, 81), and investing in science to better understand and monitor vital Earth-system processes in order to be able to detect disruptive effects from novel entities as early as possible.

Hierarchy of boundaries

An analysis of the many interactions among the boundaries (table S3 and fig. S10) suggests that two of them—climate change and biosphere integrity—are highly integrated, emergent system-level phenomena that are connected to all of the other PBs. They operate at the level of the whole Earth system (7) and have coevolved for nearly 4 billion years (82). They are regulated by the other boundaries and, on the other hand, provide the planetary-level overarching systems within which the other boundary processes operate. Furthermore, large changes in the climate or in biosphere integrity would likely, on their own, push the Earth system out of the Holocene state. In fact, transitions between time periods in Earth history have often been delineated by substantial shifts in climate, the biosphere, or both (82, 83).

These observations suggest a two-level hierarchy of boundaries, in which climate change and biosphere integrity should be recognized as core planetary boundaries through which the other boundaries operate. The crossing of one or more of the other boundaries may seriously affect human well-being and may predispose the transgression of a core boundary(ies) but does not by itself lead to a new state of the Earth system. This hierarchical approach to classifying the boundaries becomes clearer by examining in more detail the roles of climate and biosphere integrity in the functioning of the Earth system.

The climate system is a manifestation of the amount, distribution, and net balance of energy at Earth's surface. The total amount of energy sets the overall conditions for life. In Earth's current climate, a range of global surface temperatures and atmospheric pressures allows the three phases of water to be present simultaneously, with ice and water vapor playing critical roles in the physical feedbacks of the climate system. The distribution of energy by latitude, over the land and sea surfaces, and within the ocean plays a major role in the circulation of the two great fluids, the ocean and the atmosphere. These systemic physical characteristics are key spatial determinants of the distribution of the biota and the structure and functioning of ecosystems and are controllers of biogeochemical flows.

Biosphere integrity is also crucial to Earth-system functioning, where the biosphere is defined as the totality of all ecosystems (terrestrial, freshwater, and marine) on Earth and their biota (32). These ecosystems and biota play a critical role in determining the state of the Earth system, regulating its material and energy flows and its responses to abrupt and gradual change (7). Diversity in the biosphere provides resilience to terrestrial and marine ecosystems (83, 84). The biosphere not only interacts with the other planetary boundaries but also increases the capacity of the Earth system to persist in a given state under changes in these other boundaries. The ultimate basis for the many roles that the biosphere plays in Earth-system dynamics is the genetic code of the biota, the basic information bank that defines the biosphere's functional role and its capacity to innovate and persist into the future.

Planetary boundaries in a societal context

A proposed approach for sustainable development goals (SDGs) (85) argues that the stable functioning of the Earth system is a prerequisite for thriving societies around the world. This approach implies that the PB framework, or something like it, will need to be implemented alongside the achievement of targets aimed at more immediate human needs, such as provision of clean, affordable, and accessible energy and the adequate supply of food. World development within the biophysical limits of a stable Earth system has always been a necessity [e.g., (86, 87)]. However, only recently, for a number of reasons, has it become possible to identify, evaluate, and quantify risks of abrupt planetary- and biome-level shifts due to overshoot of key Earth-system parameters: (i) the emergence of global-change thinking and Earth-system thinking (88); (ii) the rise of "the Planetary" as a relevant level of complex system understanding (89–92); and (iii) observable effects of the rapid increase in human pressures on the planet (16).

The PB approach is embedded in this emerging social context, but it does not suggest how to maneuver within the safe operating space in the quest for global sustainability. For example, the PB framework does not as yet account for the regional distribution of the impact or its historical patterns. Nor does the PB framework take into account the deeper issues of equity and causation. The current levels of the boundary processes, and the transgressions of boundaries that have already occurred, are unevenly caused by different human societies and different social groups. The wealth benefits that these transgressions have brought are also unevenly distributed socially and geographically. It is easy to foresee that uneven distribution of causation and benefits will continue, and these differentials must surely be addressed for a Holocene-like Earth-system state to be successfully legitimated and maintained. However, the PB framework as currently construed provides no guidance as to how this may be achieved [although some potential synergies have been noted (54)], and it cannot readily be used to make choices between pathways for piecemeal maneuvering within the safe operating space or more radical shifts of global governance (93).

The nature of the PB framework implies that two important cautions should be observed when application of the framework to policy or management is proposed: boundary interactions and scale.

Boundary interactions

The planetary boundaries framework arises from the scientific evidence that Earth is a single, complex, integrated system—that is, the boundaries operate as an interdependent set [e.g., (94)] (table S1 and fig. S10). Although a systematic, quantitative analysis of interactions among all of the processes for which boundaries are proposed remains beyond the scope of current modeling and observational capacity, the Earth system clearly operates in well-defined states in which these processes and their interactions can create stabilizing or destabilizing feedbacks (16, 90, 95). This has profound implications for global sustainability, because it emphasizes the need to address multiple interacting environmental processes simultaneously (e.g., stabilizing the climate system requires sustainable forest management and stable ocean ecosystems).

Scale

The PB framework is not designed to be "downscaled" or "disaggregated" to smaller levels, such as nations or local communities. That said, the PB framework recognizes the importance of changes at the level of subsystems in the Earth system (e.g., biomes or large river basins) on the functioning of the Earth system as a whole. Also, there are strong arguments for an integrated approach coupling boundary definitions at regional and global levels with development goals to enable the application of "PB thinking" at levels (nations, basins, and regions) where policy action most commonly occurs [e.g., (85, 96)].

This update of the PB framework is one step on a longer-term evolution of scientific knowledge to

inform and support global sustainability goals and pathways. This evolution is needed more than ever before; there are severe implementation gaps in many global environmental policies relating to the PB issues, where problematic trends are not being halted or reversed despite international consensus about the urgency of the problems. The prospect of tighter resource constraints and rising environmental hazards is also unavoidably turning the focus onto global social equity and the planetary stewardship of Earth's life-support system. There is a need for a truly global evidence base, with much greater integration among issues, in order to respond to these global challenges. New research initiatives [e.g., Future Earth (www.futureearth.org)] provide evidence that science can respond to this need by applying Earth-system research to advance a new generation of integrated global analyses and to explore options for transformations toward sustainability. This is a clear sign that, as the risks of the Anthropocene to human well-being become clearer, research is maturing to a point where a systemic step-change is possible—and necessary—in exploring and defining a safe and just planetary operating space for the further development of human societies.

Methods summary

Our approach to building the planetary boundaries framework is described above. We have implemented the framework through an expert assessment and synthesis of the scientific knowledge of intrinsic biophysical processes that regulate the stability of the Earth system. Our precautionary approach is based on the maintenance of a Holocene-like state of the Earth system and on an assessment of the level of human-driven change that would risk destabilizing this state. For the climate change PB, there is already much literature on which to base such an assessment. For others, such as stratospheric ozone, ocean acidification, extinction rates, and P and N cycles, we have used estimates of preindustrial values of the control variable as a Holocene baseline. Where large, undesirable thresholds exist and have been studied (e.g., polar ice sheets, Amazon rainforest, aragonite dissolution, atmospheric aerosols, and the south Asian monsoon), quantitative boundaries can be readily proposed. For others, where the focus is on erosion of Earth-system resilience, the boundaries are more difficult (but not impossible) to quantify, as reflected in larger uncertainty zones.

We used large-scale assessments of the impacts of human activities on Earth-system functioning [e.g., Intergovernmental Panel on Climate Change (*17*, *18*), the International Geosphere-Biosphere Programme synthesis (*16*), and chemicals (*75*, *80*)] as sources of community-level understanding on which to propose PBs. Our update has also relied on post-2009 assessments of individual boundaries by the relevant expert research communities; examples include phosphorus (*3*), nitrogen (*5*), biosphere integrity (*7*), freshwater use (*5*, *63*), and novel entities [with a focus on chemicals (*28*, *73*)]. Finally, some new analyses have been undertaken specifically for this paper: (i) a freshwater-use PB based on the EWF approach (*33*, *63*); (ii) the linkage of the phosphorus and nitrogen boundaries via the N:P ratio in growing crop tissue (*33*); and (iii) the use of major forest biomes as the basis for the land-system change PB (*33*).

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SUPPLEMENTARY MATERIALS

www.sciencemag.org/content/347/6223/1259855/suppl/DC1
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Let’s Get Every Kid in a Park

President Obama is committed to giving every kid the chance to explore America’s great outdoors and unique history. That’s why today he launched the Every Kid in a Park initiative, which calls on each of our agencies to help get all children to visit and enjoy the outdoors and inspire a new generation of Americans to experience their country’s unrivaled public lands and waters. Starting in September, every fourth-grader in the nation will receive an “Every Kid in a Park” pass that’s good for free admission to all of America’s federal lands and waters -- for them and their families -- for a full year.

The White House
Office of the Press Secretary

February 19, 2015

As part of President Obama’s commitment to protect our Nation’s unique outdoor spaces and ensure that every American has the opportunity to visit and enjoy them, today he will launch an “Every Kid in a Park” initiative that will provide all fourth grade students and their families with free admission to National Parks and other federal lands and waters for a full year. He will also announce the creation of three new National Monuments across the country.

The President will make the announcements near the site of the historic Pullman town in Chicago, a location iconic for its history of labor unrest and civil rights advances, which will be the City’s first National Park Service unit. He also will announce that he will designate Honouliuli National Monument in Hawaii, the site of an internment camp where Japanese American citizens, resident immigrants, and prisoners of war were held captive during World War II, and Browns Canyon National Monument in Colorado, an historic site of extraordinary beauty with world-class recreational opportunities that attract visitors from around the globe. Together, these monuments will help tell the story of significant events in American history and protect unique natural resources for the benefit of all Americans.

Every Kid in a Park

In the lead up to the 100th birthday of the National Park Service in 2016, the President’s Every Kid in a Park initiative is a call to action to get all children to visit and enjoy America’s unparalleled outdoors. Today, more than 80 percent of American families live in urban areas, and many lack easy access to safe outdoor spaces. At the same time, kids are spending more time than ever in front of screens instead of

outside. A 2010 Kaiser Family Foundation study found young people now devote an average of more than seven hours a day to electronic media use, or about 53 hours a week – more than a full time job.

America's public lands and waters offer space to get outside and get active, and are living classrooms that provide opportunities to build critical skills through hands-on activities. To inspire the next generation to discover all that America's public lands and waters have to offer, the Obama Administration will provide all 4th grade students and their families free admission to all National Parks and other federal lands and waters for a full year, starting with the 2015-2016 school year. The initiative will also:

- *Make it easy for schools and families to plan trips*: The Administration will distribute information and resources to make it easy for teachers and families to identify nearby public lands and waters and to find programs that support youth outings.
- *Provide transportation support to schools with the most need*: As an integral part of this effort, the National Park Foundation (NPF) – the congressionally chartered foundation of the National Park Service – is expanding and re-launching its Ticket to Ride program as Every Kid in a Park, which will award transportation grants for kids to visit parks, public lands and waters, focusing on schools that have the most need.
- *Provide educational materials*: The initiative will build on a wide range of educational programs and tools that the federal land management agencies already use. For example, NPS has re-launched a website with over 1,000 materials developed for K-12 teachers, including science labs, lesson plans, and field trip guides. And a number of federal agencies, including the Bureau of Land Management, Forest Service, Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Department of Education, and NPS participate in Hands on the Land, a national network of field classrooms and agency resources that connects students, teachers, families, and volunteers with public lands and waterways.

To further support this effort, the President's 2016 Budget includes a total increased investment of $45 million for youth engagement programs throughout the Department of the Interior, with $20 million specifically provided to the National Park Service for youth activities, including bringing 1 million fourth-grade children from low-income areas to national parks. This increase will also fund dedicated youth coordinators to help enrich children and family learning experiences at parks and online.

EVs are here. Try to keep up.

CHARGED

ELECTRIC VEHICLES MAGAZINE

Your EV may not be so green – but then again, it may.

Posted December 17, 2014 by Charles Morris

Here we go again. A mainstream news source distills (some would say "distorts") a complex scientific study into a sensational headline, and the online echo chamber spins the story into a narrative that's almost the opposite of what the study actually found.

The study, Life Cycle Air Quality Impacts of Conventional and Alternative Light-Duty Transportation in the United States, conducted by the University of Minnesota, examined the air pollution impact for different types of vehicle powertrains, including gas, diesel, CNG, ethanol, hybrid and EV.

Under the headline "Your all-electric car may not be so green," the AP made much of one of the study's findings – that an EV powered by dirty energy sources causes substantially more air pollution than does a legacy gas vehicle.

Here's what the study says: "We find that powering vehicles with corn ethanol or with coal-based or 'grid average' electricity increases monetized environmental health impacts by 80% or more relative to using conventional gasoline. Conversely, EVs powered by low-emitting electricity from natural gas, wind, water, or solar power reduce environmental health impacts by 50% or more. Consideration of potential climate change impacts alongside the human health outcomes described here further reinforces the environmental preferability of EVs powered by low-emitting electricity relative to gasoline vehicles."

The AP article (which does not actually quote from the study) focuses on the first sentence above (EVs bad), briefly summarizing the next two sentences (EVs good) at the end of the piece.

Several EV writers, including John Voelcker and Nikki Gordon-Bloomfield, have already written detailed rebuttals of the AP article. Those few who read the study itself will find that it is far from an indictment of EVs. Rather, its conclusions serve as a call to continue the trend toward cleaner sources of electricity.

"Our assessment…of 10 alternatives to conventional gasoline vehicles finds that EVs powered by electricity from natural gas or wind, water, or solar power are best for improving air quality, whereas vehicles powered by corn ethanol and EVs powered by coal are the worst," wrote co-authors Christopher W. Tessum, Jason D. Hill and Julian D. Marshall. "Our findings thus reinforce the benefit of pairing EVs with clean electricity."

While many eagerly seized on the AP's headline as the complete story (and some didn't even trouble to include the word "may"), some at the other end of the spectrum will be reluctant to accept even the assertion that a coal-fired vehicle is dirtier than a gas guzzler. The study does leave unanswered several questions that bear on this point, including:

- The findings seem to contradict an April 2012 study by the Union of Concerned Scientists, which found that "even when charging an EV with electricity made only from coal, the dirtiest electricity source, the EV has better emissions than the average new compact gasoline vehicle." The two studies may not be using the same sets of figures – the authors of the new study don't specify exactly what they mean by a "gasoline vehicle." Prius, Hummer, or something in between?

- A coal-powered EV may be a dirty beast, but how many such vehicles are out there? The states with the largest proportion of coal-generated juice (Illinois, Ohio, North Dakota, West Virginia, and Wyoming) have few EVs. California, home to almost half of the nation's pure EVs, gets almost all of its electricity from natural gas, nuclear and renewables. Instead of comparing an ICE vehicle to a hypothetical coal-mobile, would it be more relevant to compare it to the average EV actually on the road today?

Sources: AP, Green Car Reports, Transport Evolved, National Academy of Sciences, Energy Information Administration, Union of Concerned Scientists; Images courtesy of Arnold de Leon/Flickr